Watershed Analysis

East Elk WAU
(Watershed Analysis Unit)

Roseburg District BLM

Updated as of

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF CHARTS

EXECUTIVE SUMMARY
EAST ELK WAU

Kw Issues and Concerns

The following issues and concerns were developed during the analysis or as feedback from the various individuals and groups that were interviewed.

* Impacts of Milltown Hill Dam on fish and wildlife
* Functionality of the overall Reserve System on federal lands for owl dispersal
* Water quality concerns from stream sedimentation and loss of shade impacts on temperatures
* The impacts roads are having on stream flows and aquatic habitat.

Findings

The following highlights the main findings by major topic,

Social/Economic:

. This watershed analysis unit (WAU) has a diverse array of land ownership and would need a great effort in coordinating any cooperative type projects **(Figure 1-6, Table 1-1).**

Vegetation:

. The amount of agricultore/pashxe lands have decreased by approximately 10% since 1936 as these lands have been converted to young forests or tree farms (Figures 3-1,3-2, **Tables 3-1,3-2, and Chart 3-l).**

- A majority of the Yoncalla subwatershed currently and seems to have historically maintained an agriculture/pastore type land base **(Anecdotal Cadastral** Comments from the 1850's, pg 2-2).

. Approximately 27% of forests greater than 80 years of age around the headwaters of the East Elk WAU have been converted to young forests since 1936 leaving approximately 7% of Late Seral type stands scattered throughout the WAU **(Figures** 3-1, 3-2, Tables 3-1, 3-2, and Chart 3-l).

Terrestrial Habitat and Species:

. This WAU has been identified as an important link for dispersal of Northern Spotted Chvls between Late Successional Reserves on the east and west side of the 15 corridor. The habitat in the northern portion of the East Elk WAU and to the north of this watershed on the Eugene District BLM provide that important link **(Figure 4-3).**

Hydrology:

t Some type of increases in peak flows is expected when road densities are higher than 2 mi/mi' and in East Elk WAU road densities average almost 3 times that (Figure 5-3, Table 5-9, explanation page 5-13).

. Existing data is scarce for stream temperatures (only 3 longer term locations) and for Elk Creek they are seasonally higher than state water temperature standards (Table 5-13). This may be attributed to low flows and poor riparian vegetative cover in some areas.

Geology and Soils:

. Between 6/89 and 6/94,41 landslides were identified on aerial photos. Most of these were located within harvest units or near roads. Also a high percentage of the landslides occurred within the Tyee geologic formation **(Tables 6-l and 6-4).**

+ Approximately 10% of the WAU was harvested between 6/89 and 6/94 (Table 6-S). The harvesting as well as the widespread unsurfaced roads and skid trails could collectively be sources of sediment.

Aquatic Habitat and Fish:

. The most diverse fish populations (indicator of good health) are in the upper Elk Creek (Elkhead subwatershed) and the Ward Creek drainage. The highest coho density was found in the Hardscrabble Creek drainage.

. Probable limiting factors for fish populations in the upper stream reaches is lack of large woody debris (LWD) and excessive sediment. In the larger stream reaches limiting factors include high summer stream tcmpcratorcs and low summer flows.

- The road network and the length of ditchline behveen culverts pose a high risk to thb aquatic habitat during anticipated future storm events and resulting stream flows **(Table 7-4).**

Restoration Omwtunities and Recommendations

The following are the major restoration opporhmities and recommendations by major topic. It is expected that federal timding such as "Jobs in the Woods" will most likely be spent in other higher priority watersheds that have been analyzed such as Tom Follcy (Smith River), Rook Creek, and Canton Creek ahead of East Elk WAIJ. Thus it is anticipated that most restoration for East Elk WAU will be fimded through site specific, revenue generating projects such as timber sales.

Human Uses/Fire

- Maintain road access for fire suppression because of the intermingled private and BLM land ownership. Reduce tire hazard by treatment of foels.

Restoration of Vegetation and TerresMal Wildlife Habitat

- Encourage projects that attempt to restore or develop late successional habitat in the headwater systems such as limiting salvage, snag creation, and commercial thinnings.

- Treatment of Mid Scral (25 to 80 years) stands is needed but should be scheduled to minimize disruption of dispersal habitat for owls.

- Focus the regeneration type harvests towards Mid Seral type stands in the Yoncalla subwatershed.

Aquatic/Rydrologicnl Restoration

- Classify streams in the WAU by type using Rosgen (1994). USe this for comparison, a basis for extrapolation, prediction of stream behavior, and design of stream enhancement stmcmres.

- Determine bankfidl discharge, meander width ratio of valleys, and belt width on all 4th order streams as needed for specific projects. Measure banktidl width, mean depth, width/depth ratio, maximum bankiidl depth, entrenchment ratio, channel and valley slope, sinuosity, and channel material. Develop curves of bank&l1 channel dimensions versus drainage arca for the region.

- Implement bioenginecred stream stabilization improvements and avoid the use of rip rap for channel stability. When possible, stabilize bank erosion in main channels by increasing streams& vegetation. Decrease peak flows by adding drainage stmctorcs to roads (drain dips, culverts) and decreasing the amount of or eliminating ditchlines. This is especially true for areas of unstable soils such as Buck creek.

- When installing new culverts do not constrict flow through a single culvert, instead install multiple culverts if necessary to match upstream width/depth ratios.

- Determine proper functioning condition of the riparian areas in the WAU on BLM administered lands.

- For, the next iteration of watershed analysis redraw drainage boundaries to reflect ridge to ridge drainage.

- Continue the study of this WAU so that data is collected during all seasons of the year rather than the three month period in which this analysis was conducted.

Restoration of Aquatic Habitat and Fish

- Protect areas of high species diversity and areas of key coho habitat. Harvest in Elkhead subwatershed needs to he predominantly commercial thinnings. Avoid temporary or permanent road building and defer Regeneration type

- Where appropriate, encourage the recruitment of LWD into the streams by thinning second growth stands. Seek riperian habitat by decommissioning riparian roads that are in Yoncalla and state agencies to determine limiting factors in the

- Begin upgrading the road system immediately to reduce sediment and peek flows. Require bringing the roads to RMP standards on all timber sales. Upgrade the road system in subwatersheds that have a high portion of reserves with restoration dollars, since timber sale dollars are not available.

Road Restoration and Transportation Management Objectives

- Because of the high road densities, any new road construction on BLM lands, temporary or permanent, needs to be strictly regulated and/or limited.

- Add drainage stmctores (drain dips, culverts) to roads where they are lacking. Work with BLM, state, and county maintenance crews to encourage the benefits of retaining some vegetation in the ditchlines.

Because of limited federal funds and the diverse ownership, developing transportation objectives and restoring roads in the East Elk WAU will mostly OCCUT in conjunction with timber sale projects and on a site specific basis in coordination with other lend owners. Road recommendations based on the current knowledge of existing conditions are listed on page 8-5 and would need to be refined with each individual project in coordination with private individuals and Right-of-Way holders. This list is a stating point for federally owned and controlled roads to be further developed. Roads were placed into the following four categories:

1. Natural surfaced roads across large portions of private lands needing outsloped grades where possible and development of rocked drained dips. These roads could be gated or blocked with railings to prevent erosion during wet winter months but allow tire access during the summer months. The outsloping and drain dips would lower the maintenance needs of these roads.

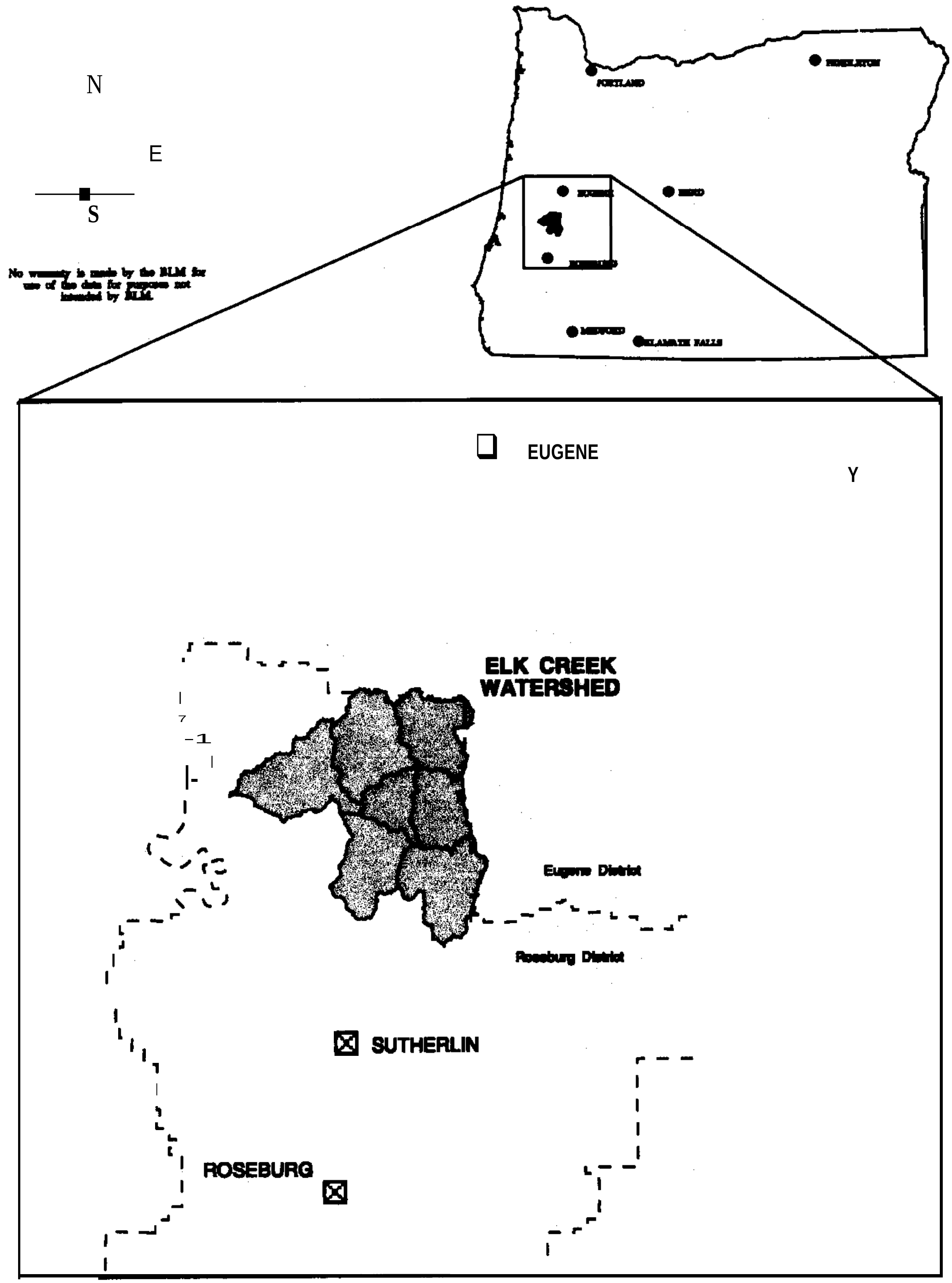
2. Natural surfaced roads needing to be rocked where BLM use warrants. This treatment would also include designing additional drain dips or culverts.

3. A very small portion of short spurs or roads could be decommissioned if not needed for fue access or other future needs.

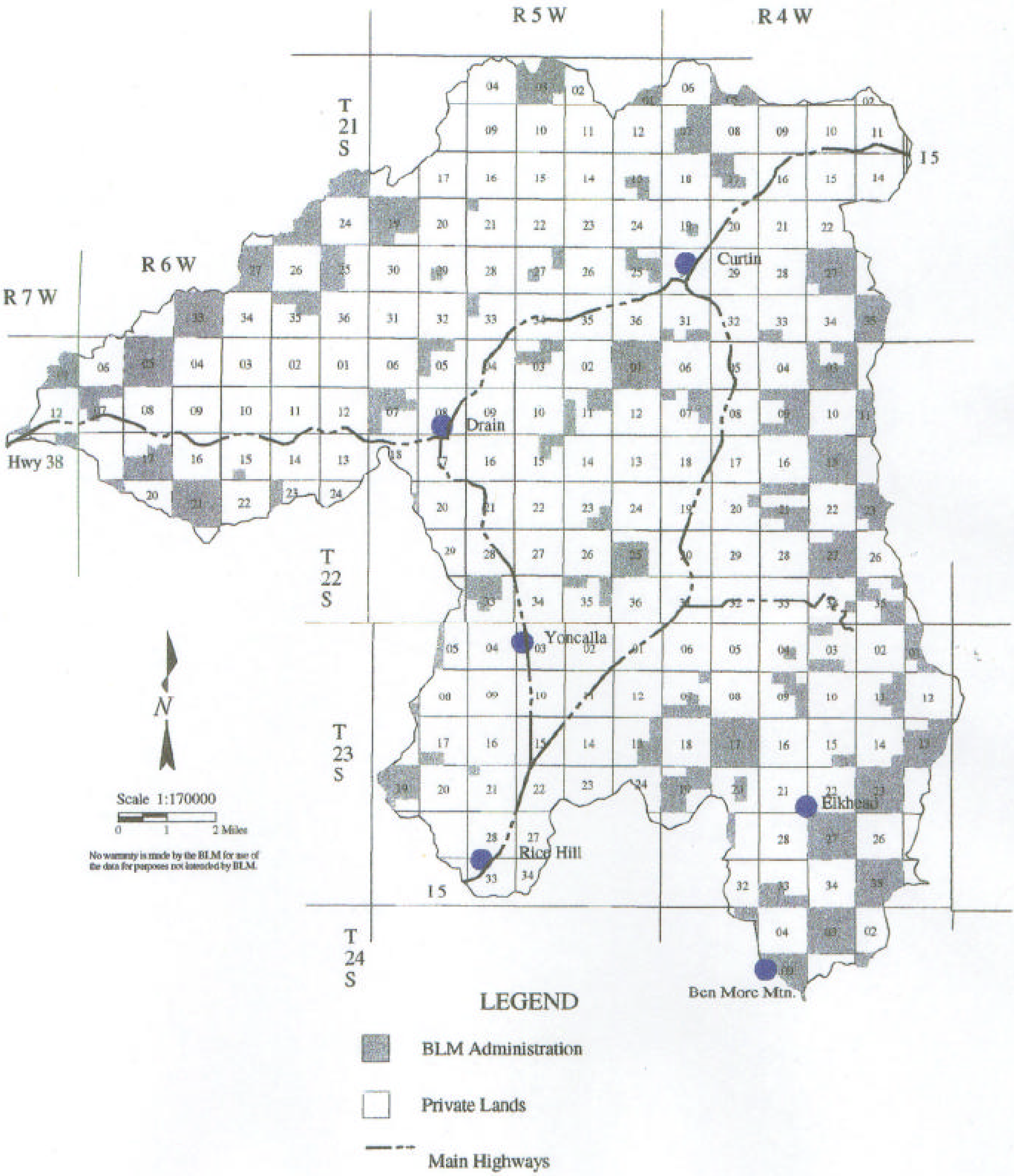
4. Midslope roads built with sidecast material and having visual evidence of sliding need the sidecast material excavated and placed on stable areas.

Figure 1-1

East Elk Creek Watershed Vicinity Map



East Elk Creek Watershed Ownership



OVERVIEW OF EAST ELK WAU

A. General Description

Size and Location: East Elk Watershed Analysis Unit (WAU) contains approximately 130,265 acres. This 204 square mile portion of the watershed is located on the lower slopes and valleys between the Cascade and coast range mountains between Roseburg on the south and Eugene on the north (Figure l-1). East Elk WAU mostly consists of low gradient coastal riverine type habitat and forms the eastern upper reaches of the Elk Creek watershed which flows west and empties into the Umpqua river at Elkton The Umpqua river system which includes the North and South Umpqua encompasses approximately 1300 square miles that flows 200 miles from the Cascade crest through the Oregon Coast Range to the Pacific Ocean.

Specific Description: All of the Elk Creek watershed, a 5th field watershed, contains approximately 224,3 IO acres and consists of 13 subwatersheds. East Elk watershed analysis unit (WAU) was selected as the analysis unit for several reasons: 1)To make the information be of a more manageable size 2)To cover in one analysis BLM lands that are scattered amongst a high percentage of private lands 3)To analyze eastern portion of the Elk Creek under one watershed analysis 4)And to analyze the portions of the Elk Creek watershed that have not already been analyzed (most of the subwatersheds in the west portion of Elk Creek have been analyzed by the Tyee Resource Arca). East Elk WAU stretches approximately 19 miles south to north dissected by Interstate Hwy 5 and 18 miles east to west dissected in the western portion by State Hwy 38 (Figure **l-2). The** major towns or cities within this WAU include Rice Hill, Yoncalla, Drain, and Curtin The elevation ranges from about 300 feet on the west end of the WAU to 2,670 feet at the southern end at Ben More Mtn. The mountain ranges encompassing this WAU average approximately 2,000 feet. This WAU is made up of 7 major subwatersheds: Dodge Camp, Elkhead, Lower Pass, Putnam Valley, Upper Elk, Upper Pass, and Yoncalla. These subwatersheds are also divided into 41 drainages (Figure 1-3, l-4).

Climate and Vegetation: Average annual rainfall ranges from 50 inches in Putnam Valley (bchveen Drain and Elkton) to 70 inches in the upper elevations to the east. Most of the precipitation occurs in the form of rain since over 95% of the WAU has elevations below 2000 feet. The majority of the landscape is dominated by seedling and young second growth Douglas-fir. This is a result from harvesting the older timber stands during the last 100 years and replanting of those lands to Douglas-fir. The valley bottoms maintain a mixture of oak and madrone woodlands amongst the agriculture/pasture lands.

People and Recreation: As stated above this WAU contains 4 rural communities connected by major state and federal highways. Probably the most prominent activity impacting both the communities as well as the environment in East Elk is the proposed Milltown Hill dam **(Figure l-5).** Located in the Elkhead subwatershed, this project is designed to resolve problems from lack of water for municipal, industrial, and irrigation use. The dam would not only provide for the water needs and some flood control but also recreation opportunities associated with the reservoir.

B. Ownership and Federal Land Use Allocations

The land ownership is very diverse with very little of the 130,265 acres The following is a breakdown of the major industrial land owners and federal administration **(Figure l-6, Table 1-l).** Acreages are approximate and other major private land owners not listed include former governor Bob Straub and Donna Wwlley.

Land Owner	&Q	[illegible]
Government (BLM)	22,063	17%
Whipple	10,748	8%
Weyerhaeuser Co.	9,859	8%
Seneca/Jones Timber	9,769	7%
Lone rock Timber	9,658	7%
Giustiana Brothers	9,248	7%

Of the 130,265 acres within East Elk WAU, approximately 22,063 acres (17%) is federally managed under the following Forest Plan and Roseburg District RMP land use allocations (Figure **l-7, Cbnrt I-1, Table 1-2)** (note: these acreages are estimates based on computer generated maps):

	Acres. Fed Lands	% Fed Lands	% of Watershed
Late Successional Reserves (LSR)	1,189 ac	5.4%	0.9%
Marbled Murelet Reserves (MMR)	4,710 ac	21.5%	3.6%
Other Reserves	5,914 ac	26.9%	4.5%
Connectivity	6,461 ac	29.4%	5.0%
General Forest Management Area (GFMA)	3,684 ac	16.8%	2.8%

1, Late Successional, Marbled Mwrelet, and Other Reserves
The management objectives for all reserves are to protect and enhance old-growth forest conditions. Of the 11,807 acres of reserves in East Elk WAU, approximately 5,177 acres (44% of reserves in East Elk) are currently in late-successional type forests (80+ years) (Figure 1-8, Charts 13, l-3, **Table l-3).**

The Other Reserves as shown, on Rgure 1-7, include rip&m reserves, unmapped pre-1994 Northern Spotted Owl @SO) designated habitat areas, reserves for marbled murrelets, and areas withdrawn because they are considered *not* suitable for timber production (TPCC).

The rip&m reserves were established on federal lands as one component of the Aquatic Conservation Strategy to protect the health of the aquatic system and its dependent species and provide incidental benefits to upland species. The reserves were designated to help maintain and restore riparian structures and functions, benefit fish and rip&m-dependent non-fish species, enhance habitat conservation for organisms dependent on the transition zone between uplands and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat (ROD, B-13).

The riparian reserves were estimated from the stream network characterized by the Geographic Information System (GIS) computer database as well as on the ground verification and mapping of intermittent (1st and 2nd order) streams. A slope distance of approximately 200 feet was be used as representing the average site-potential tree height for the East Elk WAU (ROD, pg. 9). The site-potential tree height of 200 feet was determined from 24 plots taken on the lower one-third of the hill slopes in the Elk Creek watershed. Thus the following riparian reserve widths were used for the estimating the total amount of riparian reserves: 200 feet (61 meters) for intermittent, non-fish bearing streams and 400 feet (122 meters) for fish bearing streams. Because many of the actual field intertnittent streams are unmapped and because only known fish bearing streams based on a fish presence/absence inventory conducted in 1996 on BLM lands was used for the 400 foot riparian reserve width, the total amount of riparian reserves represented in this analysis is most likely underestimated. Actual projects would use on-the-ground stream information.

In East Elk WAU there are approximately fourteen residual habitat areas designated around NSO site centers. These areas are expected to provide some protection for nesting groves found to be suitable by owls in the past. They are not, in themselves, expected to be capable of supporting pairs of nesting owls, but rather to provide nesting habitat in the future while the surrounding forest stands mature.

Several areas were reserved from timber management in order to protect potential nesting habitat for the marbled murrelet. These areas are described as marbled murelet reserves as opposed to designated critical habitat. These areas were selected because they contain potential habitat based on the presence of several key habitat elements within the estimated range of the species. The elements include large diameter (32 inch+ DBH) trees, a canopy layer height equal to or greater than l/2 the site potential tree height, stmctural deformities, mossy large limbs or other conditions which create nesting platforms.

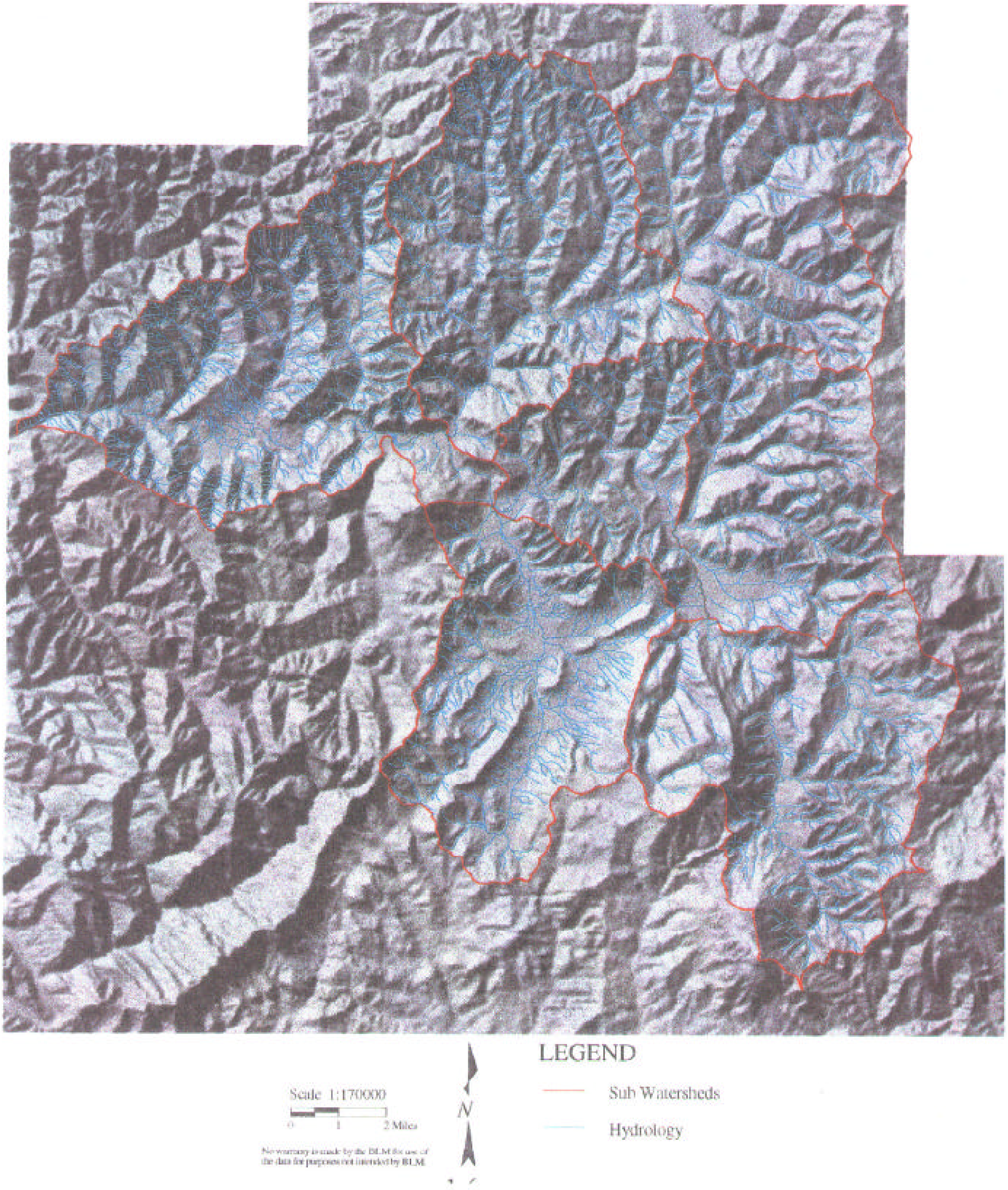
Areas designated as not suitable for timber production (TPCC withdrawn) are much smaller and scattered.

2. Matrix Lands
   a. Connectivity
   The objective of these lands on the overall landscape is to provide a bridge between larger blocks of old growth stands and Riparian Reserves. This provides habitat for breeding, feeding, dispersal, and movement of old growth-associated wildlife and fish species. East Elk WAU contains approximately 6,461 acres of Connectivity. Within this land designation there are approximately 1,672 acres in young pre-commercial age class (0 to 25 years), 3,070 cres potentially available for a commercial thinning (25 to 80 years), and 1,719 acres available for regeneration

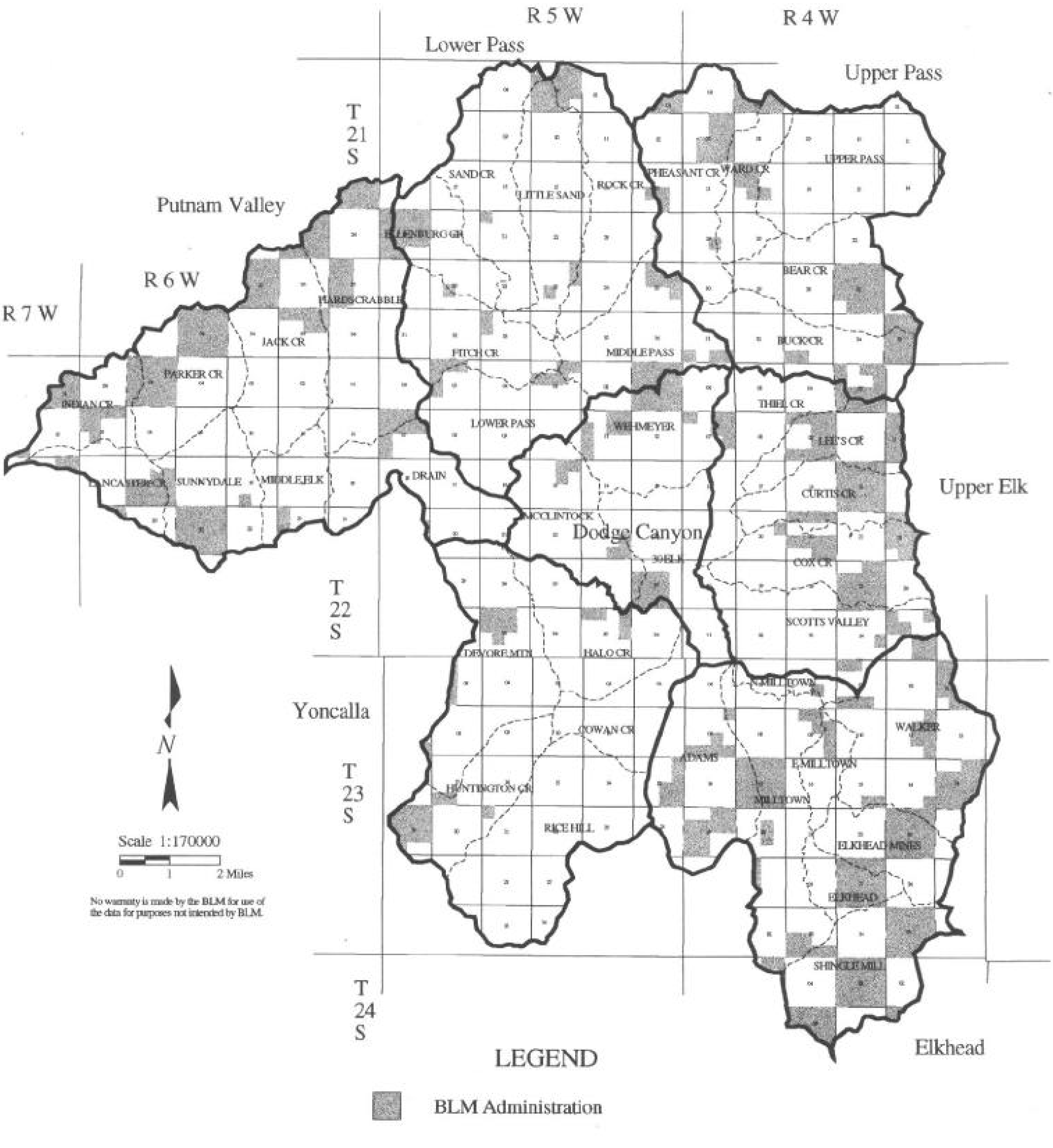
harvest (80+ years) (Figure 13, Chart **1-4, Table l-4).**

b. General Forest Management Area (GFMA)
The objective of these lands is to manage on a regeneration harvest cycle of 70 to 110 years, leaving a biological legacy of 6 to 8 trees per acre to assure forest health. There is approximately 3,684 acres of GFMA in East Elk WAU. Within this land designation there are approximately 1,161 acres in young pre-commercial age class (0 to 25 years), 1,661 acres potentially available for a commercial thinning (25 to 80 years), and 907 acres available for regeneration harvest (80+ years) **(Figure** 13, Chart l-4, Table l-4).

East Elk Creek Shaded Relief Map

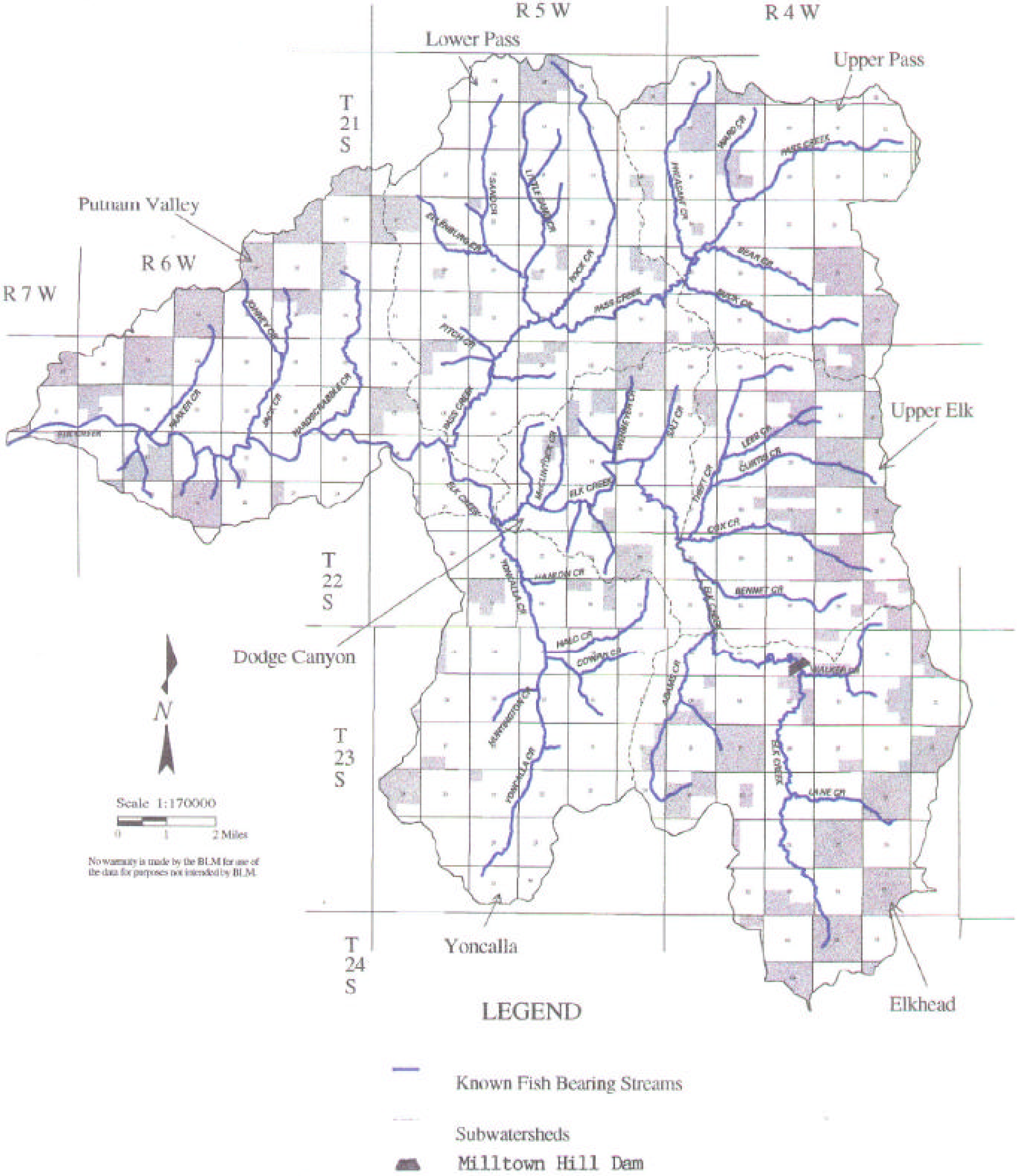


East Elk Creek Subwatersheds & Drainages

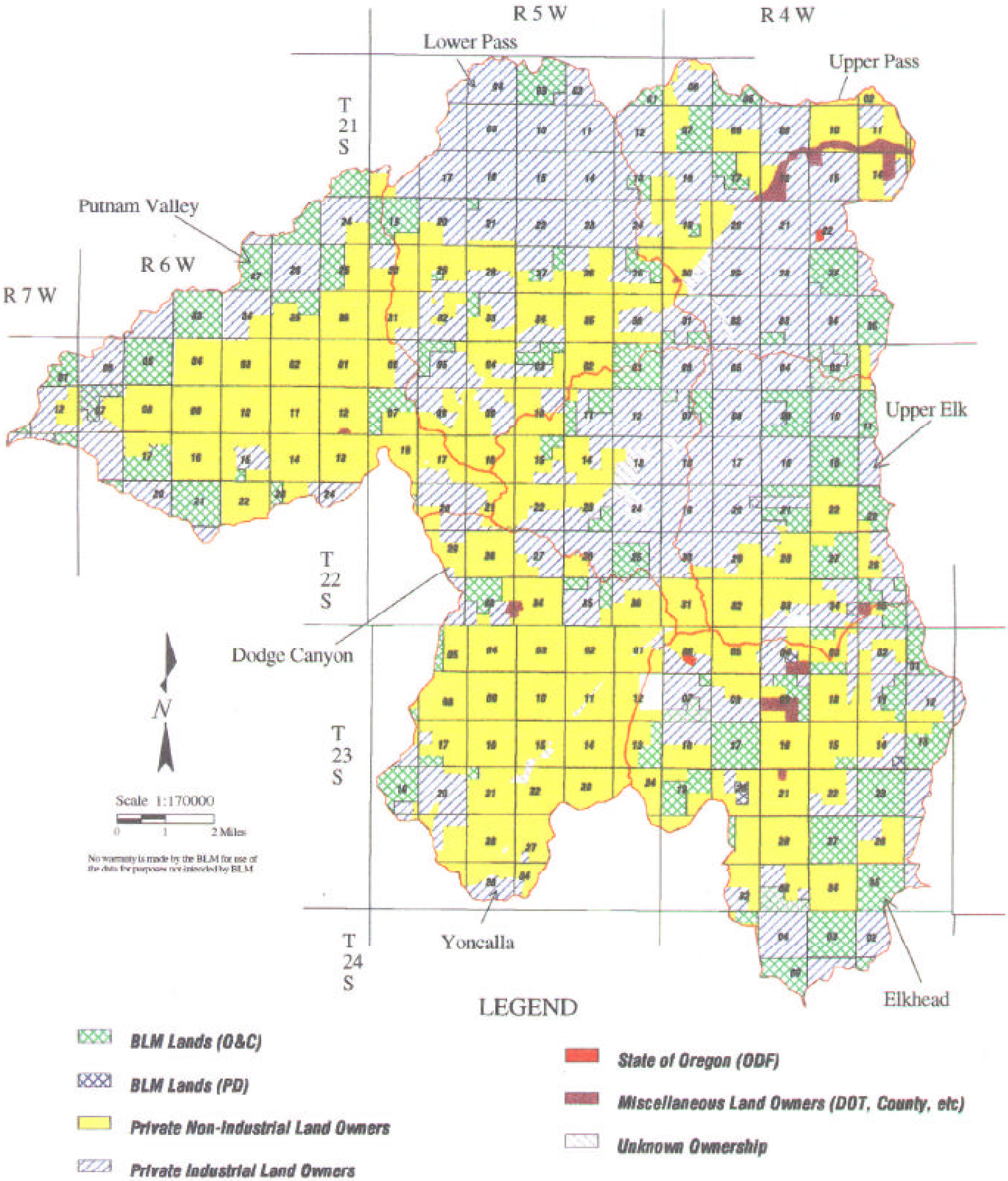


East Elk Main Streams

(Known Fish Distribution)



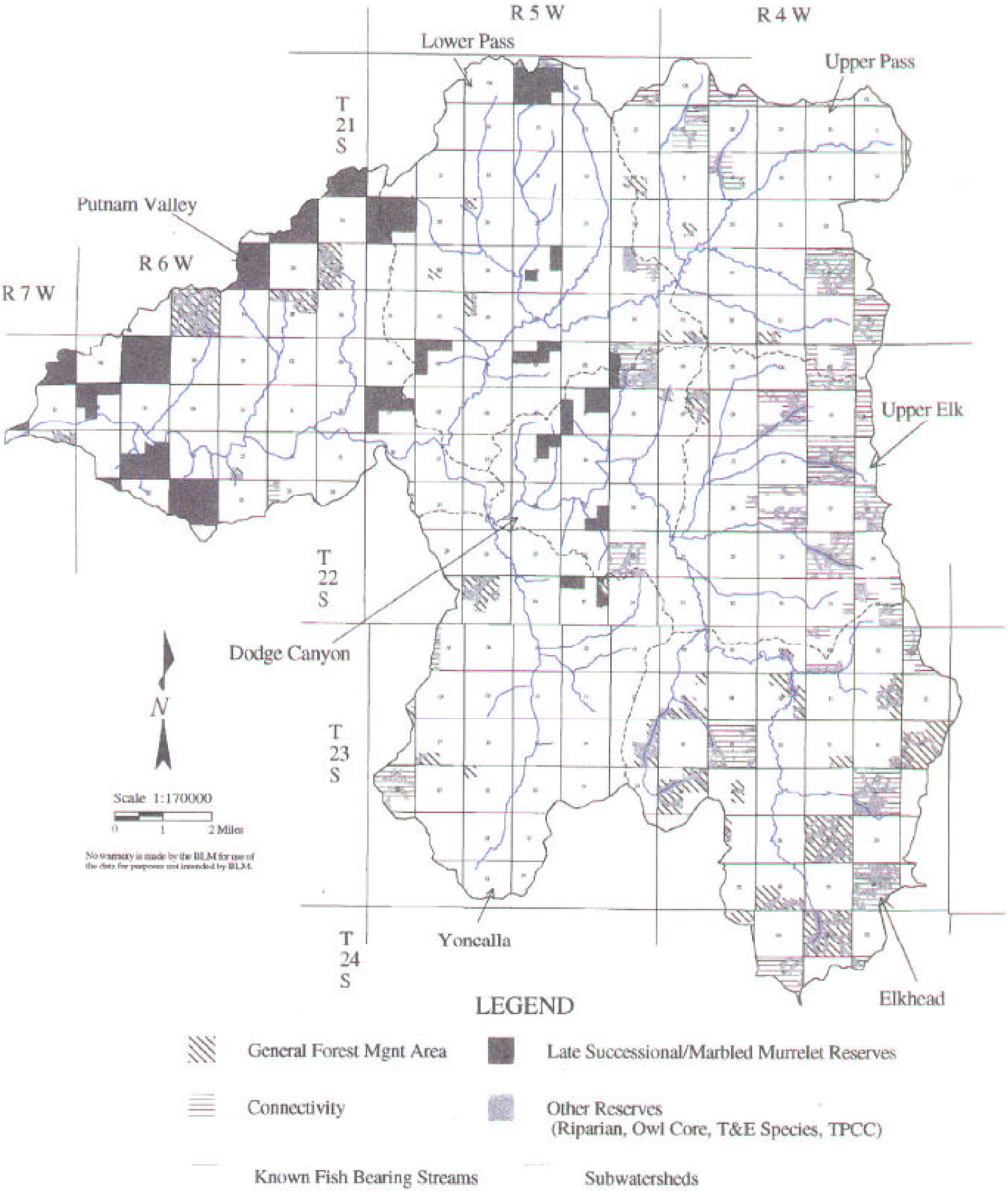
Private Land Ownership

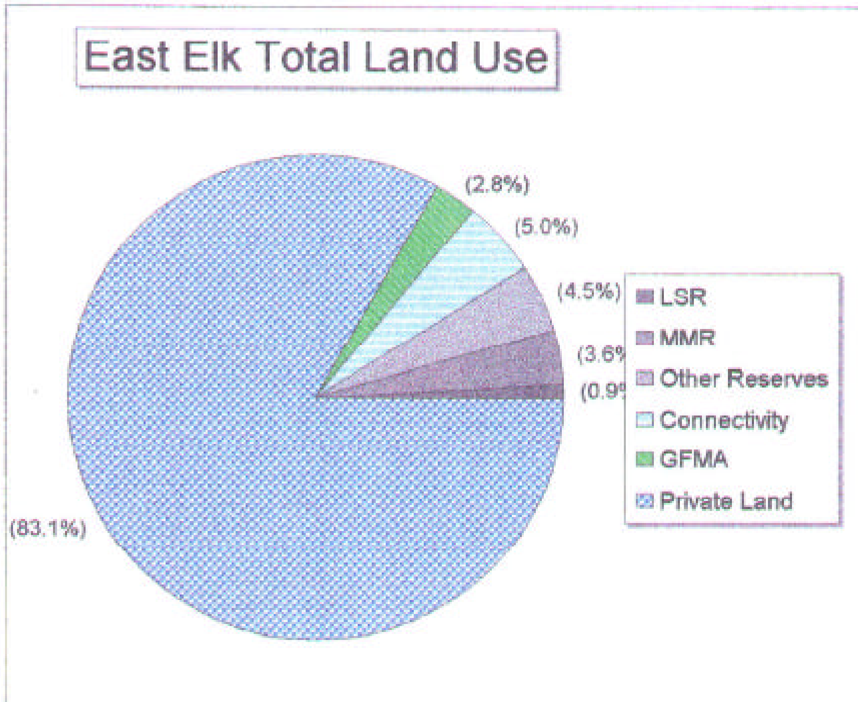


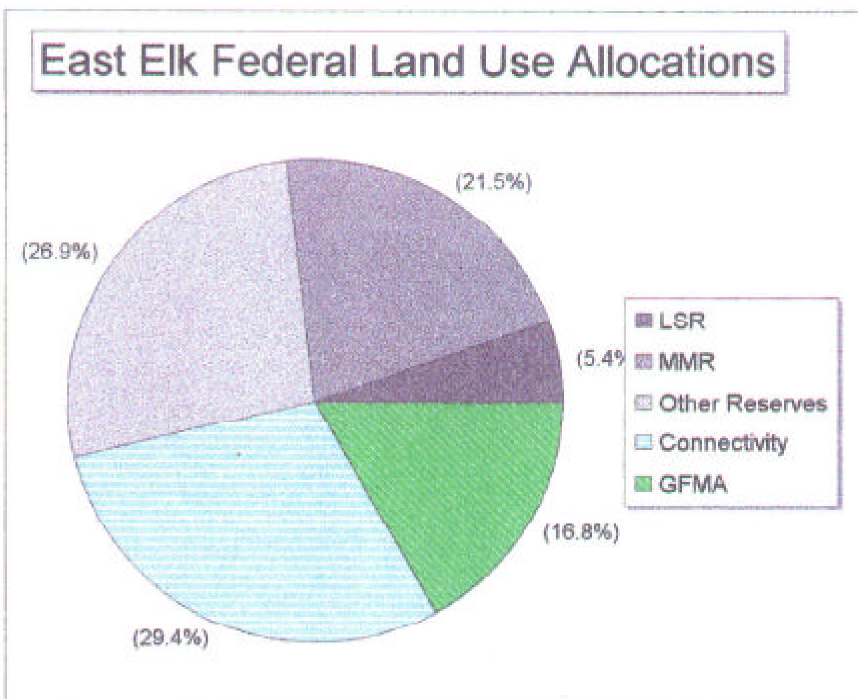
Major Private Land Owners
East Elk Creek Watershed

LAND OWNERSHIP	Acres
PUBLIC LAND	
State of Oregon	
Oregon Dept of Forestry	53
Oregon DOT	569
Bureau of Land Management	
Oregon and California Grant Lands	21,824
Public Domain Lands	239
TOTAL ACRES	**22,685**
Industrial	
Bear Creek Timber	619
Bohemia	637
Douglas County	366
Giustiana Brothers	9248
Lone Rock Timber	9658
NW Timber Affiliates	81
Seneca/Jones Timber	9769
West Coast Forest Resources	360
Weyerhaueser Corp	9859
Whipple	10,748
Willamette Industries	148
TOTAL ACRES	**51,493**
Non-Industrial	
Private Non-Industrial Land Owners	55,102
Unknown Land Owners	2,057
TOTAL ACRES	**57,159**

East Elk Land Use Allocation




East Elk Total Land Use
(2.8%)
(5.0%)
(4.5%)
(3.6%
(0.9%
(83.1%)
LSR
MMR
Other Reserves
Connectivity
GFMA
Private Land


East Elk Federal Land Use Allocations
(21.5%)
(26.9%)
(5.4%
(16.8%)
(29.4%)
LSR
MMR
Other Reserves
Connectivity
GFMA

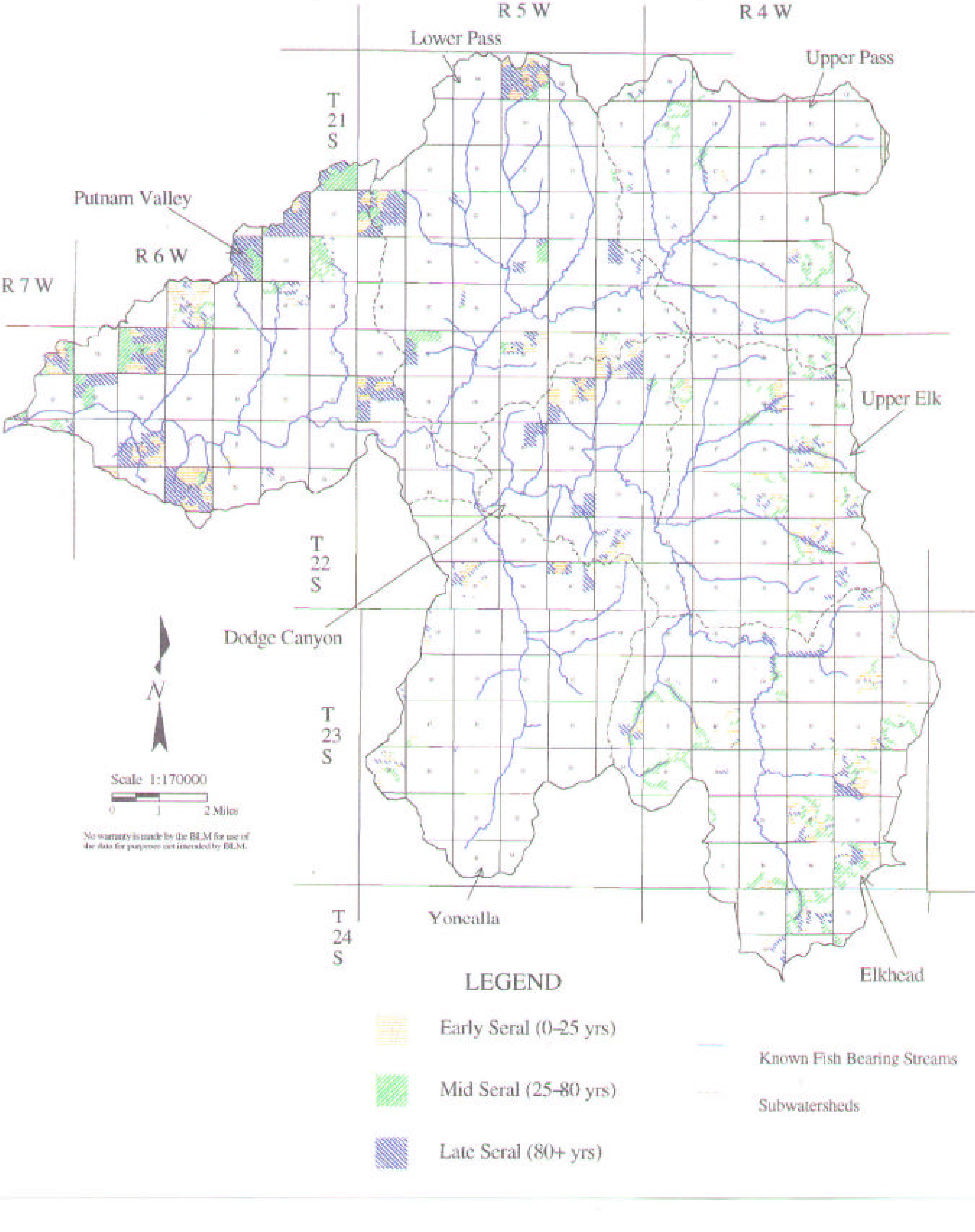
EAST ELK CREEK LAND USE ALLOCATIONS

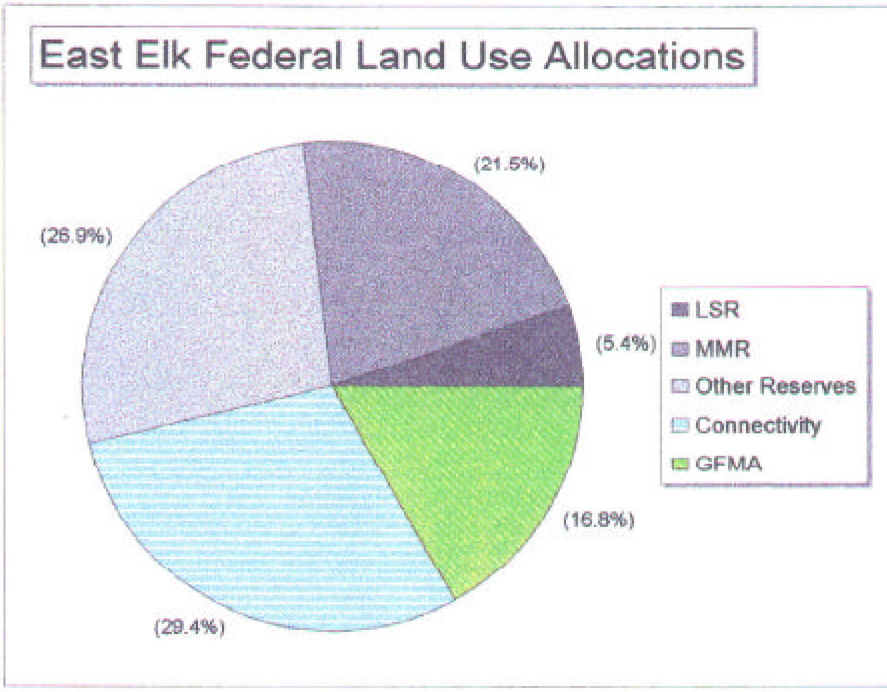
Drainages / Subwatersheds	LAND USE ALLOCATIONS: Late Successional Reserves acres	%	Marbled Murrelet Reserves acres	%	Other Reserves acres	%	Connectivity acres	%	GFMA acres	%	Private Lands acres	%	TOTAL ACRES
30 Elk	0	0%	27	1%	94	3%	150	5%	0	0%	2861	91%	3132
McClintock	0	0%	222	7%	23	1%	48	1%	0	0%	2958	91%	3251
Wehmeyer	0	0%	323	9%	262	7%	108	3%	33	1%	2864	80%	3590
Dodge Camp	0	0%	572	6%	379	4%	306	3%	33	0%	8683	87%	9973
Adams	0	0%	0	0%	496	12%	175	4%	457	11%	2874	72%	4002
E. Milltown	0	0%	0	0%	51	6%	0	0%	79	9%	781	86%	911
Elkhead	0	0%	0	0%	235	21%	0	0%	264	23%	629	56%	1128
Elkhead Mines	0	0%	0	0%	305	14%	287	13%	96	4%	1534	69%	2222
Milltown	0	0%	0	0%	160	4%	309	7%	426	9%	3641	80%	4536
N. Milltown	0	0%	0	0%	18	3%	19	3%	11	2%	540	92%	588
Shingle Mill	0	0%	0	0%	711	19%	571	15%	391	10%	2093	56%	3766
Walker	0	0%	0	0%	379	7%	386	7%	554	10%	4151	76%	5470
Elkhead	0	0%	0	0%	2356	10%	1747	8%	2278	10%	16243	72%	22624
Ellenburg Cr	372	19%	0	0%	0	0%	0	0%	15	1%	1575	80%	1962
Fitch Cr	0	0%	145	5%	33	1%	0	0%	71	2%	2669	91%	2918
Little Sand	0	0%	280	8%	0	0%	0	0%	0	0%	3099	92%	3379
Lower Pass	0	0%	190	6%	0	0%	0	0%	0	0%	3230	94%	3420
Middle Pass	0	0%	122	4%	182	5%	246	7%	85	2%	2818	82%	3453
Rock Cr	0	0%	240	6%	32	1%	28	1%	23	1%	3469	91%	3792
Sand Cr	0	0%	32	1%	26	1%	5	0%	25	1%	3499	98%	3587
Lower Pass	372	2%	1009	4%	272	1%	279	1%	219	1%	20359	90%	22510
Drain	0	0%	182	6%	0	0%	0	0%	13	0%	3091	94%	3286
Hardscrabble	736	13%	188	3%	197	4%	0	0%	152	3%	4213	77%	5486
Indian Cr	0	0%	708	35%	0	0%	0	0%	0	0%	1308	65%	2016
Jack Cr	81	2%	426	10%	101	2%	0	0%	102	3%	3354	83%	4064
Lancaster Cr	0	0%	347	22%	46	3%	0	0%	34	2%	1185	74%	1612
Middle Elk	0	0%	0	0%	361	17%	63	3%	281	13%	1470	68%	2175
Parker Cr	0	0%	474	18%	0	0%	0	0%	0	0%	2118	82%	2592
Sunnydale	0	0%	671	23%	28	1%	0	0%	13	0%	2214	76%	2926
Putnam Valley	817	3%	2996	12%	732	3%	63	0%	596	2%	18953	78%	24156
Cox Cr	0	0%	0	0%	427	12%	613	18%	0	0%	2397	70%	3437
Curtis Cr	0	0%	0	0%	281	12%	488	21%	0	0%	1529	67%	2298
Lee's Cr	0	0%	0	0%	293	14%	562	26%	0	0%	1268	60%	2123
Scotts Valley	0	0%	0	0%	107	3%	253	6%	0	0%	3639	91%	3999
Thiel Cr	0	0%	0	0%	109	4%	104	4%	90	3%	2539	89%	2842
Upper Elk	0	0%	0	0%	1218	8%	2020	14%	90	1%	11372	77%	14700
Bear Cr	0	0%	0	0%	193	6%	532	16%	0	0%	2694	79%	3419
Buck Cr	0	0%	0	0%	181	5%	410	12%	69	2%	2641	80%	3301
Pheasant Cr	0	0%	0	0%	163	4%	475	11%	90	2%	3470	83%	4198
Upper Pass	0	0%	0	0%	15	0%	32	1%	0	0%	4682	99%	4729
Ward Cr	0	0%	0	0%	67	4%	261	15%	13	1%	1385	80%	1726
Upper Pass	0	0%	0	0%	628	4%	1710	10%	172	1%	14872	86%	17374
Cowan Cr	0	0%	0	0%	0	0%	0	0%	0	0%	2157	100%	2157
Devore Mtn	0	0%	0	0%	166	3%	52	1%	184	4%	4360	92%	4762
Halo Cr	0	0%	133	4%	38	1%	16	0%	30	1%	3207	94%	3424
Huntington Cr	0	0%	0	0%	133	5%	268	9%	83	3%	2375	83%	2859
Rice Hill	0	0%	0	0%	0	0%	0	0%	0	0%	5726	100%	5726
Yoncalla	0	0%	133	1%	337	2%	334	2%	297	2%	17825	94%	18928
EAST ELK	1189	1%	4710	4%	5914	5%	6461	5%	3684	3%	108307	83%	130265

Last Mod.: 6/5/96, File: landuse.wk3

East Elk Seral Age Classes Within Reserves

(Reserves on Federal Lands)




East Elk Federal Land Use Allocations
(21.5%)
(26.9%)
(5.4%)
(16.8%)
(29.4%)
LSR
MMR
Other Reserves
Connectivity
GFMA

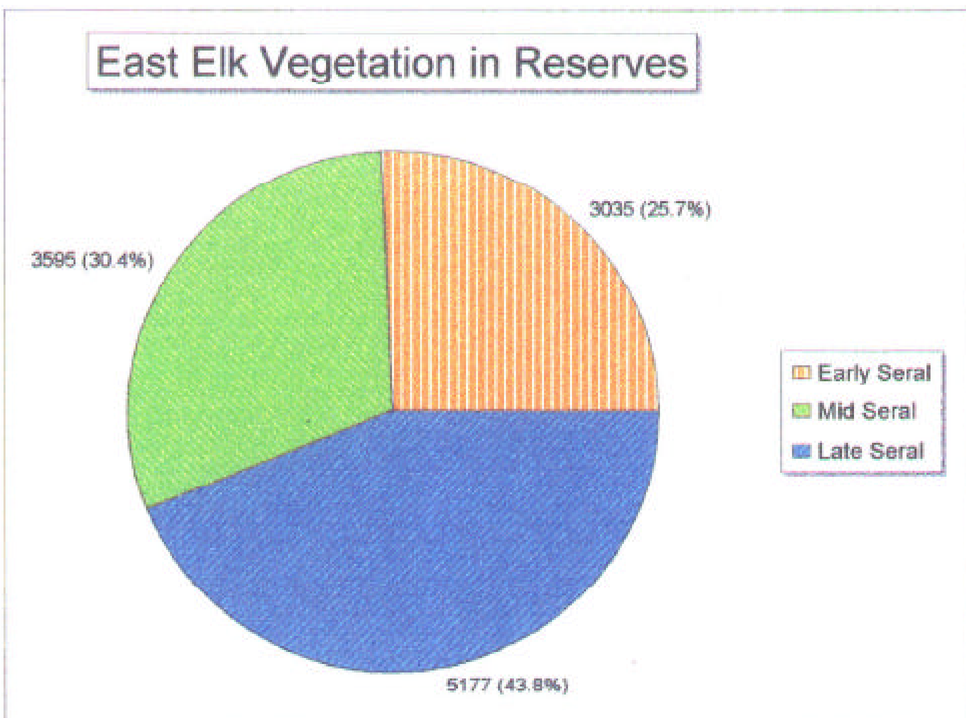
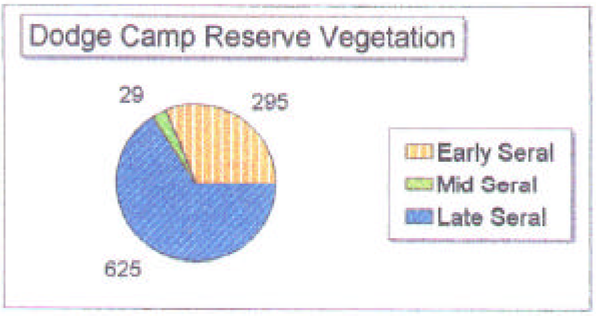
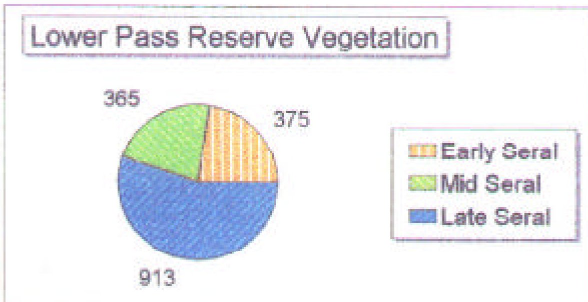

East Elk Vegetation in Reserves
3035 (25.7%)
3595 (30.4%)
5177 (43.8%)
Early Seral
Mid Seral
Late Seral

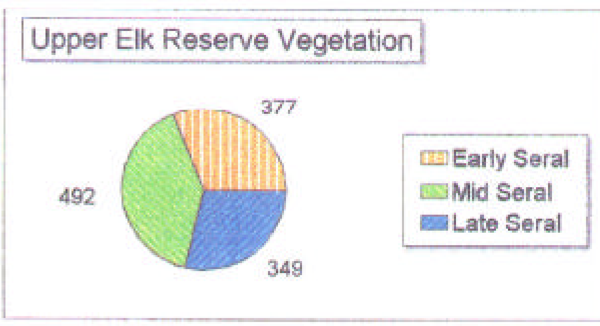
Chart 1-3

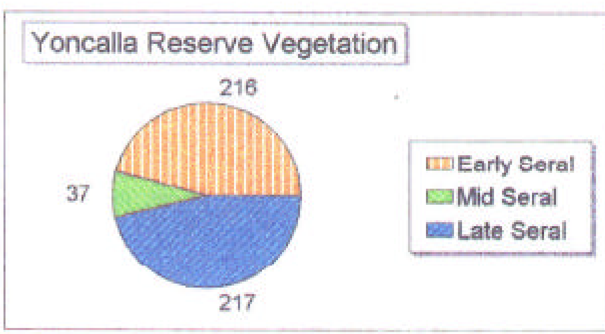
SUBWATERSHED SERAL AGE CLASSES IN RESERVES

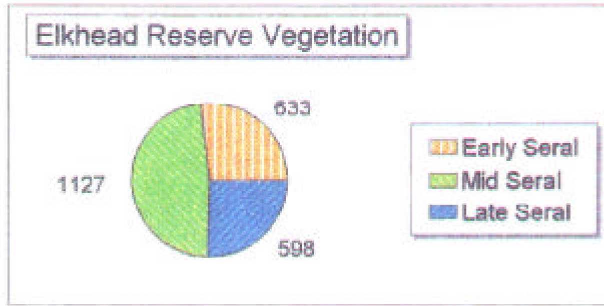
(Acres, Federal Lands Only)

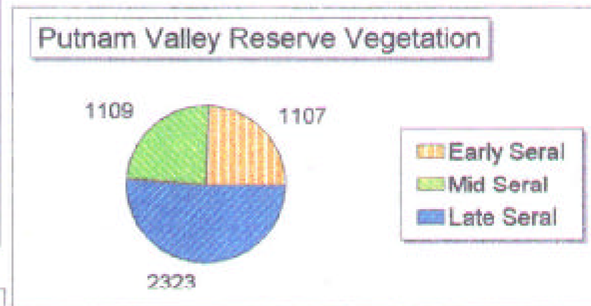


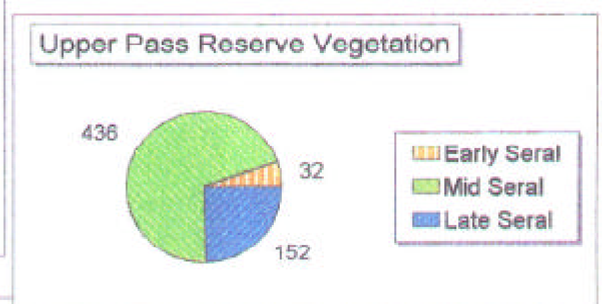












EAST ELK CREEK VEGETATION IN RESERVES
(Early, Mid & Late Seral Age Classes within Reserves)
(Federal Lands Only)

Drainages / Subwatersheds	Early Seral (0-25 yrs) acres	Early Seral (0-25 yrs) %	Mid Seral (26-80 yrs) acres	Mid Seral (26-80 yrs) %	Late Seral (80+ yrs) acres	Late Seral (80+ yrs) %	TOTAL ACRES
30 Elk	46	38%	0	0%	75	62%	121
McClintock	3	1%	1	0%	240	98%	244
Wehmeyer	246	42%	28	5%	310	53%	584
Dodge Camp	**295**	**31%**	**29**	**3%**	**625**	**66%**	**949**
Adams	77	16%	367	74%	52	10%	496
E. Milltown	0	0%	51	100%	0	0%	51
Elkhead	99	42%	86	37%	50	21%	235
Elkhead Mines	100	33%	77	25%	129	42%	306
Milltown	47	29%	72	45%	41	26%	160
N. Milltown	0	0%	0	0%	18	100%	18
Shingle Mill	188	26%	352	49%	172	24%	712
Walker	122	32%	122	32%	136	36%	380
Elkhead	**633**	**27%**	**1127**	**48%**	**598**	**25%**	**2358**
Ellenburg Cr	51	17%	0	0%	254	83%	305
Fitch Cr	18	7%	172	70%	56	23%	245
Little Sand	44	16%	38	14%	198	71%	280
Lower Pass	51	27%	53	28%	86	45%	190
Middle Pass	97	32%	32	10%	175	58%	304
Rock Cr	101	37%	70	26%	101	37%	272
Sand Cr	13	23%	0	0%	44	77%	57
Lower Pass	**375**	**23%**	**365**	**22%**	**913**	**55%**	**1654**
Drain	4	2%	4	2%	174	96%	182
Hardscabble	189	21%	173	19%	529	59%	891
Indian Cr	95	10%	568	61%	269	29%	931
Jack Cr	45	8%	151	25%	402	67%	597
Lancaster Cr	126	31%	44	11%	233	58%	403
Middle Elk	337	40%	142	17%	356	43%	835
Parker Cr	0	----	0	----		----	0
Sunnydale	311	44%	27	4%	361	52%	699
Putnam Valley	**1107**	**24%**	**1109**	**24%**	**2323**	**51%**	**4538**
Cox Cr	145	34%	144	34%	138	32%	427
Curtis Cr	125	44%	82	29%	74	26%	281
Lee's Cr	74	25%	151	52%	67	23%	293
Scotts Valley	0	0%	42	39%	65	61%	107
Thiel Cr	33	30%	72	66%	4	4%	109
Upper Elk	**377**	**31%**	**492**	**40%**	**349**	**29%**	**1218**
Bear Cr	11	6%	144	75%	38	20%	193
Buck Cr	0	0%	122	67%	60	33%	182
Pheasant Cr	4	2%	127	78%	32	20%	163
Upper Pass	12	78%	2	16%	1	6%	15
Ward Cr	5	7%	41	61%	21	31%	67
Upper Pass	**32**	**5%**	**436**	**70%**	**152**	**25%**	**620**
Cowan Cr	0	----		----		----	0
Devore Mtn	82	50%	0	0%	84	50%	166
Halo Cr	70	41%	3	2%	99	58%	172
Huntington Cr	64	48%	34	26%	35	26%	133
Rice Hill	0	----	0	----	0	----	0
Yoncalla	**216**	**46%**	**37**	**8%**	**217**	**46%**	**470**
EAST ELK	**3035**	**26%**	**3595**	**30%**	**5177**	**44%**	**11807**

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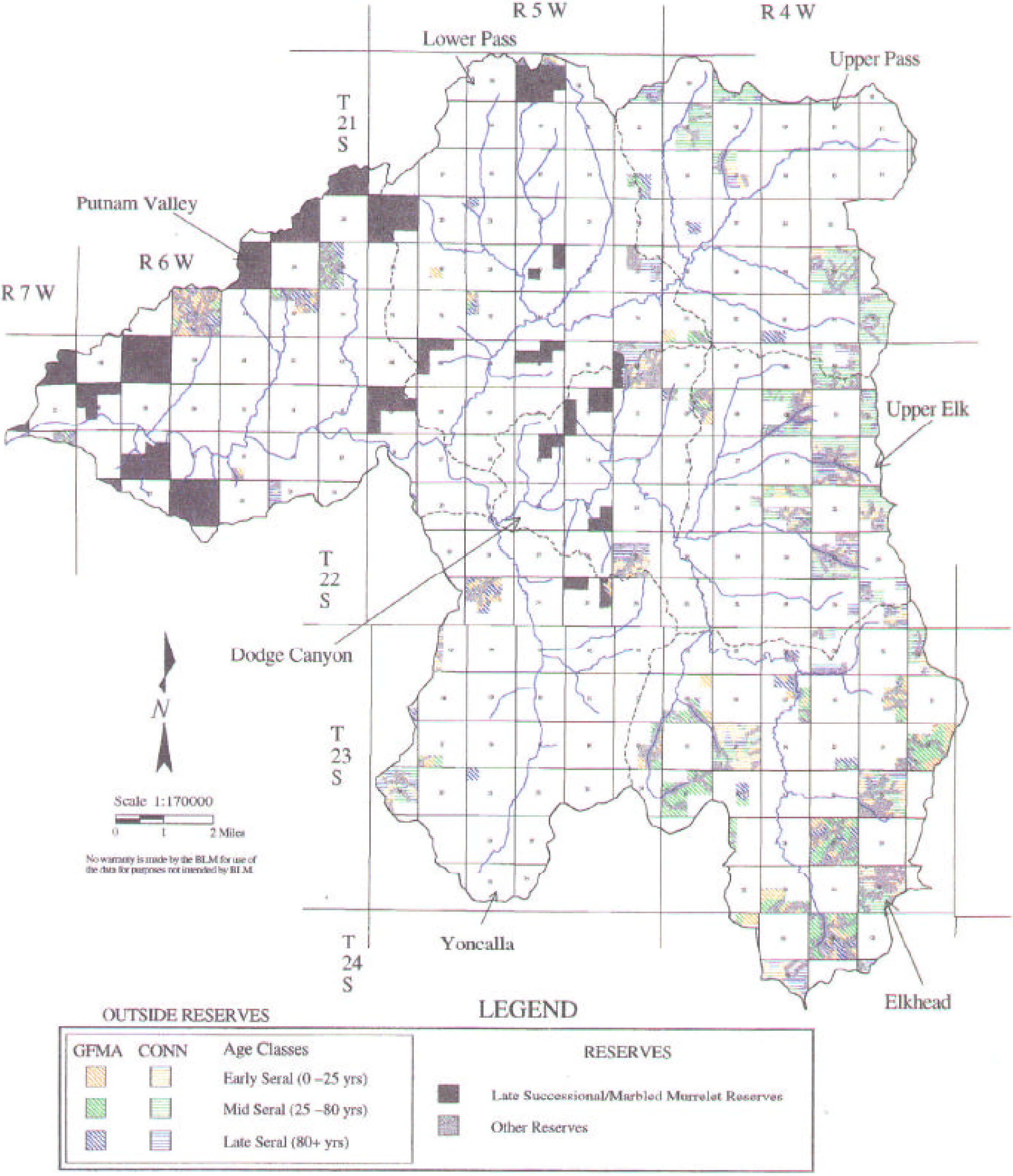
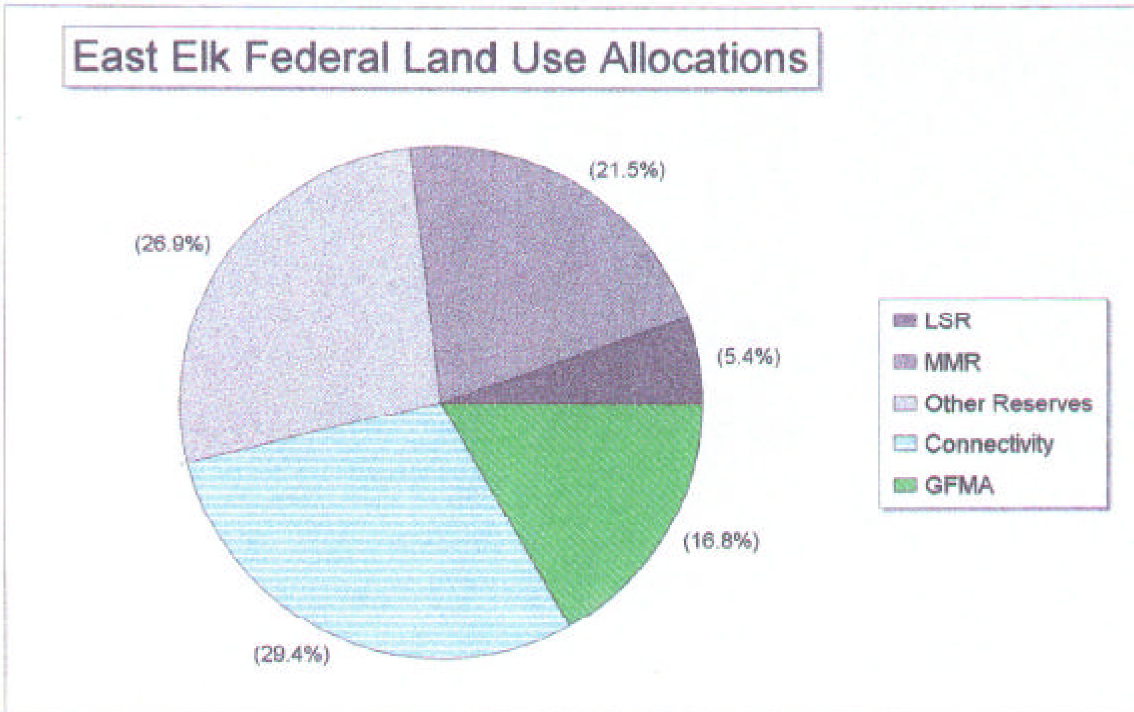
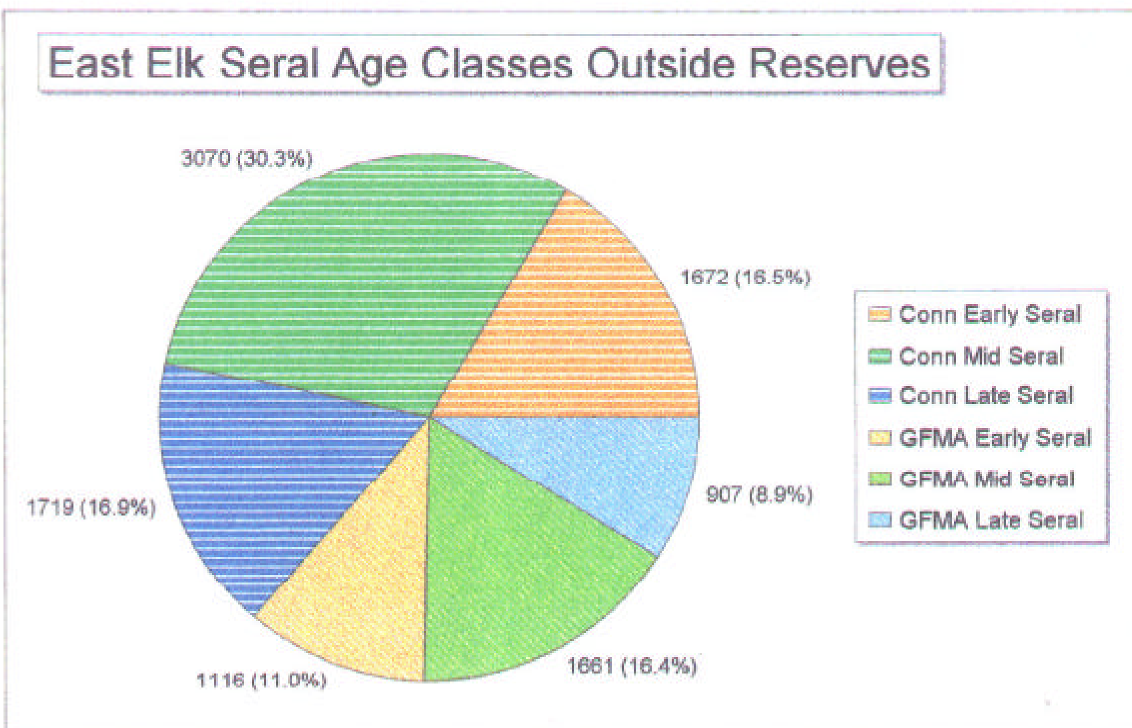
East Elk Seral Age Classes Outside Reserves

(Federal Lands)




East Elk Federal Land Use Allocations
(21.5%)
(26.9%)
(5.4%)
(16.8%)
(29.4%)
LSR
MMR
Other Reserves
Connectivity
GFMA


East Elk Seral Age Classes Outside Reserves
3070 (30.3%)
1672 (16.5%)
1719 (16.9%)
907 (8.9%)
1116 (11.0%)
1661 (16.4%)
Conn Early Seral
Conn Mid Seral
Conn Late Seral
GFMA Early Seral
GFMA Mid Seral
GFMA Late Seral

EAST ELK CREEK

EARLY, MID, & LATE SERAL AGE CLASSES OUTSIDE RESERVES
(Federal Lands Only)

Drainage	RESERVES		CONNECTIVITY						General Forest Mgnt Area (GFMA)						TOTAL ACRES
			Early Seral (0-25 yrs)		Mid Seral (25-80 yrs)		Late Seral (80+ yrs)		Early Seral (0-25 yrs)		Mid Seral (25-80 yrs)		Late Seral (80+ yrs)		
Subwatersheds	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	
30 Elk	121	45%	79	29%	0	0%	71	26%	0	0%	0	0%	0	0%	271
McClintock	244	84%	17	6%	0	0%	31	11%	0	0%	0	0%	0	0%	292
Wehmeyer	584	81%	79	11%	0	0%	29	4%	0	0%	15	2%	18	2%	725
Dodge Camp	949	74%	175	14%	0	0%	131	10%	0	0%	15	1%	18	1%	1288
Adams	496	44%	79	7%	68	6%	28	2%	66	6%	380	34%	11	1%	1128
E. Milltown	51	39%	0	0%	0	0%	0	0%	14	11%	65	50%	0	0%	130
Elkhead	235	47%	0	0%	0	0%	0	0%	65	13%	124	25%	75	15%	499
Elkhead Mines	305	44%	162	24%	93	14%	32	5%	18	3%	70	10%	8	1%	688
Milltown	160	18%	204	23%	66	7%	39	4%	177	20%	145	16%	104	12%	895
N. Milltown	18	38%	0	0%	11	23%	8	17%	0	0%	0	0%	11	23%	48
Shingle Mill	712	43%	235	14%	178	11%	158	9%	103	6%	203	12%	85	5%	1674
Walker	379	29%	117	9%	118	9%	151	11%	223	17%	274	21%	57	4%	1319
Elkhead	2356	37%	797	12%	534	8%	416	7%	666	10%	1261	20%	351	6%	6381
Ellenburg Cr	372	96%	0	0%	0	0%	0	0%	11	3%	4	1%	0	0%	387
Fitch Cr	178	71%	0	0%	0	0%	0	0%	37	15%	13	5%	21	8%	249
Little Sand	280	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	280
Lower Pass	190	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	190
Middle Pass	304	48%	10	2%	31	5%	205	32%	32	5%	50	8%	3	0%	635
Rock Cr	272	84%	23	7%	5	2%	0	0%	0	0%	20	6%	3	1%	323
Sand Cr	57	66%	5	6%	0	0%	0	0%	0	0%	0	0%	25	29%	87
Lower Pass	1653	77%	38	2%	36	2%	205	10%	80	4%	87	4%	52	2%	2151
Drain	182	93%	0	0%	0	0%	0	0%	0	0%	7	4%	6	3%	195
Hardscabble	1119	88%	0	0%	0	0%	0	0%	15	1%	82	6%	55	4%	1271
Indian Cr	703	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	703
Jack Cr	607	86%	0	0%	0	0%	0	0%	24	3%	24	3%	54	8%	709
Lancaster Cr	393	92%	0	0%	0	0%	0	0%	2	0%	18	4%	14	3%	427
Middle Elk	835	71%	4	0%	0	0%	59	5%	157	13%	60	5%	64	5%	1179
Parker Cr	0	—	0	—	0	—	0	—	0	—	0	—	0	—	0
Sunnydale	699	98%	0	0%	0	0%	0	0%	13	2%	0	0%	0	0%	712
Putnam Valley	4538	87%	4	0%	0	0%	59	1%	211	4%	191	4%	193	4%	5196
Cox Cr	428	41%	169	16%	297	29%	147	14%	0	0%	0	0%	0	0%	1041
Curtis Cr	281	37%	166	22%	214	28%	108	14%	0	0%	0	0%	0	0%	769
Lee's Cr	293	34%	69	8%	406	47%	87	10%	0	0%	0	0%	0	0%	855
Scotts Valley	107	30%	5	1%	97	27%	151	42%	0	0%	0	0%	0	0%	360
Thiel Cr	109	36%	1	0%	88	29%	15	5%	42	14%	40	13%	8	3%	303
Upper Elk	1218	37%	410	12%	1102	33%	508	15%	42	1%	40	1%	8	0%	3328
Bear Cr	193	27%	40	6%	438	60%	54	7%	0	0%	0	0%	0	0%	725
Buck Cr	181	27%	0	0%	331	50%	79	12%	0	0%	6	1%	63	10%	660
Pheasant Cr	164	22%	14	2%	388	53%	73	10%	0	0%	27	4%	63	9%	729
Upper Pass	15	32%	25	53%	3	6%	4	9%	0	0%	0	0%	0	0%	47
Ward Cr	67	20%	38	11%	167	49%	56	16%	0	0%	0	0%	13	4%	341
Upper Pass	620	25%	117	5%	1327	53%	266	11%	0	0%	33	1%	139	6%	2502
Cowan Cr	0	—	0	—	0	—	0	—	0	—	0	—	0	—	0
Devore Mtn	166	41%	34	8%	0	0%	18	4%	78	19%	7	2%	99	25%	402
Halo Cr	172	79%	13	6%	0	0%	3	1%	16	7%	5	2%	9	4%	218
Huntington Cr	133	27%	84	17%	71	15%	113	23%	23	5%	22	5%	38	8%	484
Rice Hill	0	—	0	—	0	—		—	0	—	0	—	0	—	0
Yoncalla	471	43%	131	12%	71	6%	134	12%	117	11%	34	3%	146	13%	1104
EAST ELK	11805	54%	1672	8%	3070	14%	1719	8%	1116	5%	1661	8%	907	4%	21950

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HUMAN USES

A. Characterization

The dominant human uses in the East Elk WAU are timber production, agriculture, transportation, and service-related. There are no treaty rights or tribal uses in this WAU, although individual tribal members may utilize the area.

Timber production and harvest, on both federal and private lands, constitute, perhaps, the most economically important use of the WAU today. Beginning in the 1850s in the Pass Creek area, timber harvest has grown from supplying local lumber markets to a niche in the international market.

Agricultural activity, which was the basis of Euroamerican settlement in the 1850s and provided the economic backbone for many years, originally focused on subsistence farming. Over the years market or commercial production replaced subsistence farming. Various cereal and fruit crops have been important in the past, but the current emphasis appears to be on livestock, both cattle and sheep.

The Elk Creek watershed has been a transportation corridor for as long as written records have been kept and probably for millennia before that. When the first Euroamericans came through the Umpqua basin, fur trappers in circa 1819-21, they probably entered by way of Pass Creek, moved south via Yoncalla Creek, and eventually crossed over into Calapooya Creek. The Applegate Trail, Highway 99, and Interstate 5 have all followed roughly the same route. The watershed has also provided a corridor downstream to the main Umpqua and eventually the ocean. Drain at one time served as a transportation hub for rail, stage, and freight lines connecting the coast and the interior valleys.

Service-related uses include providing food, gas, lodging, and other essentials to tourists and commercial travelers as well as local residents. Localities such as Rice Hill and Curtin and the city of Drain are examples.

B. Issues and Key Questions

Because of the limited BLM ownership in the WAU and the limited ability of BLM to affect human uses, the primary issue wll be the timber harvest level from federal land.

C. Current Conditions

Because of the limited BLM ownership in the WAU and the limited ability of BLM to affect human uses, no effort was made to quantify the extent of the major human uses in the WAU. Previous major efforts at documenting human uses in the vicinity, such as the Milltown Hill EIS and the Northern Douglas County Cooperative Water Resources Study, revert to looking at Douglas County as a whole. This is probably a result of the lack of data for the specific area and/or the amount of time that would be required to extract the data.

D. Reference Conditions

Human uses in the East Elk WAU probably span the last **8,000 years** and reflect the activities common to much of the West, including broad-spectrum hunting and gathering, fur trapping, subsistence and commercial agriculture, transportation, logging and lumbering, mining, and recreation.

Prehistoric use of the watershed prior to'Euroamerican entry is little known at this time. Eleven archaeological sites have been recorded to date, most of them in the upper or southern end of the watershed, above the proposed Milltown Hill dam. The sites include seasonal campsites, a village of the Yoncalla Kalapuyans, and a petroglyph boulder considered religiously important by modem descendants of the Yoncalla.

The Yoncalla, related to the many Kalapuyan bands of the Willamette Valley, followed a way of life that involved seasonal use of a wide variety of plant and animal resources. Operating out of winter villages, such as the one near Yoncalla, they would move about the landscape, hunting, fishing, and collecting plants as they became available. **Salmon** and camas provide the bulk of the diet, but were supplemented by numerous other foodstuffs, such as nuts,

a

berries, seeds, roots, waterfowl, and large and small game.

Although the specifics are undocumented for the watershed, it appears that the Yoncalla practiced burning as a land management tool. When David Douglas, the English botanist, passed through the area in the fall of 1826 he noted that the Indians in the upper Willamette Valley were burning the lowlands. Various reasons have been ascribed to this practice. One reason was to keep the vegetation cleared out to provide better hunting visibility along the valley bottoms. A related reason was to provide better foraging habitat for large game. Further to the south, in the Cow Creek vicinity, it has been noted that burning was conducted to ready the tarweed plant suitable for harvesting.

Comments by early settlers in the area, notably in the Yoncalla area, suggest that the creek bottoms were largely grasslands and required little clearing for agricultural purposes, perhaps suggestive of an active indigenous burning regime. A cursory examination of cadastral survey notes from the mid-nineteenth century indicates a landscape of open grasslands on the valley bottoms, "oak openings" on the moderate slopes, and heavy timber on the upper slopes. This appears to be a vegetation regime similar to that noted on the 1936 vegetation map **(Figure 3-l).**

Euroamerican entrance into the area occurred between 1819 and 1821 when trappers employed by the Northwest Fur Company passed through the area on an expedition to explore the Umpqua Basin. Trappers, eventually based in the Hudson's Bay Company outpost at Elkton, continued to operate in the watershed for more than three decades. Euroamerican settlement began in earnest in the late 1840s after the Applegate brothers and their party had pioneered the Applegate Trail as a southern alternative entry into the Willamette Valley. By 1850 the Drain, Yoncalla, Scotts Valley, and Hayhurst Valley areas were being homesteaded and used for subsistence fanning. The 1860 census for the larger Umpqua basin indicates that 55% of the population considered themselves agriculturalists, with another 22% listed as laborers, presumed to be agriculture-related. Specialized trades and professionals accounted for another 15%.

Subsistence agriculture remained the core of economic activity in the watershed for quite some time. The 1880 and 1890 censuses both indicate that agriculture and associated labor accounted for nearly two-thirds of the late-century work force. Craftsmen and professionals comprised 12-13% of the work force. In 1880 logging and lumbering occupied 5% of the population, while the figure had dropped to 3% by 1890.

The coming of the O&C railroad in 1872 opened the watershed to a number of new economic activities. The actual construction of the railroad provided a new, but temporary, source of employment. But more importantly, it provided an impetus to the lumbering industry in the form of a demand for railroad ties and bridge and trestle consmtction materials. The railroad would eventually provide the means for distributing the watershed's resources to the larger regional and ultimately international markets.

Although lumbering began in the watershed in 1852 or 1853, when Newton Mulvaney stated a small sawmill on Pass Creek, it would be nearly a century before the industry attained its preeminent statlls in the economic activity of the area. The development boom in Southern California and subsequent demand for lumber around the hxn of the century provided the first glimpse of what was to come By the early part of the twentieth century the Leona Mills Lumber Company on Pass Creek was one of the major lumber producers in Douglas County, surpassed only by the Gardiner Mill Company near the mouth of the Umpqua. The Leona mill produced nearly 10% (c. 27 mmbf) of the Umpqua basin lumber between 1902 and 19 15, second only to the Gardiner plant's 63%.

Small gyppo mills and generally low production figures dominated the industry in the watershed until the late 1940s. The post-war boom and associated housing demands fueled the large-scale development of the industry. With rail and highway networks in place, north County lumber entrepreneurs were able to ship their products nationwide to meet the demands and usher in another phase of economic development.

Perhaps the newest phase of economic development is on the horizon. The Milltown Hill dam (Figure **1-5,** pg l-8) has been in the planning phase for a number of years. In 1985, Douglas County and the Bureau of Reclamation initiated a study to find solutions to a lack of water for municipal, industrial, and irrigation use. The study resulted in a finding that a dam located in the Elkhead Valley, near the confluence of Walker and Elk creeks, would provide the necessay water for future developments and economic diversification. Plagued by controversy concerning the financing and the potential for mercury contamination, the project is several years behind schedule. Currently Douglas County is consulting with National Marine Fisheries Service about the impacts of this project on the listed cutthroat trout. When completed, the project will provide irrigation water for Scotts Valley and Yoncalla, municipal water for Drain, Yoncalla, and Rice Hill, mral domestic water, recreation opportunities associated with the reservoir, limited flood control, and improved fish and wildlife habitat.

VEGETATION

A. Historical Perspective and Reference Conditions

In order to develop an understanding of the processes that have contributed to the current vegetative conditions found in the East Elk WAU, we have reconstructed what the vegetation most likely would have looked like in the mid-1930's. We have used several sources of information during this process, combining and comparing data to achieve an approximate picture of historical conditions.

Although there were no comprehensive forest surveys done in this region prior to the mid 1940's, there are some maps, dated 1936, available from the USFS that give general descriptions of forest types in Douglas County in terms of diameter class and species **(Figure 3-1, Table 3-l).** Although the scale of these maps is large and detail lacking, the information can be used with caution to compare with current vegetative conditions. The diameter classes from these type maps were correlated to the current seral age classes. Thus the diameter class of 0 to 6 inches is correlated to forest stands that are behveeu 0 and 25 years of age. Diameter classes of 6 to 20 inches and greater than 20 inches were correlated to forest stands of age 25 to 80 years (Mid Seral) and greater than 80 years (Late Seral) respectively.

Conditions described from this figure were used to approximate historical or natural conditions found in the WAU. The 'natural range of conditions' can only be approximated, however, as no 'real' information exists to describe the condition of the WAU prior to this time and the processes that created this landscape. Some inferences can be made in **future iterations** of watershed analysis from timber cruise information of past harvest units on diameters of older, residual trees, amounts and sizes of down wood and understoty development. Descriptions of soil types and aspects also give clues to vegetation history. This information helps to create au historical view of the types of processes **working** in various portions of the watershed and the resulting timber and vegetation types. Fire history can also help give a picture of the processes that have effected the vegetation types.

B. Fire History

An average fire return interval (FRI) for all Oregon Douglas-fir type forests over the past few centuries has been estimated at I50 years (Agee, 1993). Agee states "..fire frequency estimates were made using a variety of methods and periods and probably do not reflect the actual fire record of any single decade or century of the current millennium." A regional average tire-return interval for the Douglas-fir zone has been estimated at 230 years (Fahnestock and Agee 1983). The tire-cycle model used for this analysis was characterized by significant variability over time and space. The notion that an "average" or "regular" fire return interval can be calculated in Coast Range forests is unrealistic. Agee believes "Episodic" is a better descriptor of fires occurring in our area.

Stand replacing fires in the moist, coastal forests north of Roseburg can range from 200 to more than 500 years. Much of the WAU is still influenced by the moist, marine climate typical of coast forests. However, in the forest lauds east towards the Cascade Range, natural fire is more frequent. The average FRI for the East Elk WAU is estimated at greater than 150 years.

A iire regime is a generalized description of the role fire plays in au ecosystem. One of several systems for describing fire regimes uses combinations of frequency and intensity to describe six tire regimes (Agee, 1981a). For this analysis, the WAU is considered a combination of 2 of Agee's fire regimes.

> Fire regime 5: Long return interval crown fires and severe surface tires in combinations (100-300 year return intervals).
>
> Fire regime 6: Very long return interval crown fires and severe surface fires in combination (over 300 year return intervals).

A second system of fire regime classification is based on the effects of fires on dominant vegetation, from low to high tire severity (Agee, 1990). With this system, the WAU would be classified as a high severity tire regime. High severity fire regimes can have 70% or more of their basal area removed. Douglas-fir, the dominant tree species in this area has the unique ability to resist damage by fire because of the bark thickness on older trees. As a result, many existing natural stands appear as a mosaic or patch work of areas of old growth, scattered mature trees and younger stands of even-aged conifers. On any site, all levels of fire severity will be present over large scales of space and time, but characteristically in different proportions.

Specific fire history data for this WAU has not been collected. Methods for determining fire history are described by Agee in Fire Ecoloev of Pacific Northwest Forests. Sampling of fire scar data is considered a good means of establishing fire history, but they are not commonly present in high severity fire regimes. In some casa stand age class determination can accurately establish the dates of past fires. Due to the checker-board ownership pattern and the extensive logging in this area, this approach is not feasible. Time required and costs of collecting data from iire scars or age class information to create a fire history of this WAU can not be justified at this time. By interpreting historical records and maps and with a professional knowledge of fire behavior and tire effects, general assumptions will be made and used as the basis of this analysis.

C. 1914 Oregon **State Forest Type Map**

In 1914, Oregon State forester, F. A. Elliott, commissioned development of a map of the state. The extent of prehistoric and historic forest tires is shown, as are commercial timber stands, burned areas successfully reforested and burned areas not reforested. This map has been digitized on computer and **Figure 3-3** shows how the East Elk WAU was classified in 1914. Hypothetical descriptions of the vegetation are provided for these areas based on my knowledge of tire behavior, tire effects, forestry, and history (reference the attached map).

This WAU is dominated by private lands, nearly 83% of the WAU is in this Classification. This private land is split between small ranches, rural homesites, with the majority in industrial forest ownership. BLM administered lands make up about 17% of the WAU. These lands are scattered and very intermingled with the private lands. According to the 1914 map the vast majority of BLM lands were classified as merchantable timber. Much of the private land, specifically in the lower valley bottom areas was determined to be brush and non-timbered lands. However, private lands on the upper slopes and ridges were timbered. Approximately 4000 acres in the north portion of the WAU had been logged as of 1914.

The 1914 map makes no distinction between matare timber (old growth) and younger stands of merchantable size. It is highly unlikely that the area classified as merchantable timber was a continuous block of “old growth” timber. Man caused and lightning caused fire (the result is the same) has likely been the dominant natural disturbance in this area for hundreds, perhaps thousands of years before white settlement. It is likely that most of the timber stands present in the WAU in 1914 originated from stand replacement tires. These forests were not untouched by human hands prior to white settlement. Humans have lived here as families for thousands of years.

The area classified as “burned areas not re-stocking” is estimated to have been a stand replacement fire that occurred at least lo-15 years earlier. Many large fires occurred around the turn of the cenhxy in the Northwest, but less than 2% of the WAU was determined to be in this classification. These burned areas were probably the result of severe surface and crown fires. “Early season crown fires, or crown scorch tires in poor seed years, may be associated with a lack of early regeneration after a fire.” (Agee 1993) In coast range forests, tree recruitment or reestablishment can take 50 years or more. Because of this, the fire that caused these burns may have occurred in the 1870’s

The area classified as brush occupied about 15% of the area in 1914. These areas may have resulted from earlier stand replacement tires that consumed any existing tree canopy. More likely, repeated Indian and settler bums may have eventually consumed all the conifers in these foothill areas. Perhaps there was no a canopy to bum, the area may have always been brush component. Re&rdless of the previous vegetation, fires have burned here with high enough intensity, leaving no seed source for conifer re-establishment. Brush sprouted from below ground adventitious buds and completely occupied the site. More recently, with increased tire suppression, many of these areas have become reforested either naturally, or by conversion of bmsh to conifer stands.

The area classified as non-timber is mostly in the valley bottoms and surrounding foothills. This area, 25% of the WAU, was likely grassland with a few scattered large trees the result of repeated burning over long periods of time. The native Indians used fire to improve forage for game. Grasslands were burned in the late summer. It must be assumed that some of these fires burned more than grasslands, perhaps becoming stand replacement fires in the timbered areas higher up on the ridges. Repeated burnings probably contributed to the large amount of "brush areas" shown on the 1914 map. Fires are known to have burned all summer until the fall rains extinguished them. "ln all the low valleys of the Umpqua there was very little undergrowth, the annual fires set by the Indians preventing young growth of timber". (George Riddle, 1851).

D. Additional **Fire History Maps**

Fire classification maps from 1850 and 1920 (Figures 3-4 and 3-5) provide some limited insight to the effect tire had in the WAU. Maps from as early as 1850 show large tracts of land being disturbed by tire. These maps only provide coverage for the northern quarter of the WAU, but depict a landscape that was significantly influenced by fire. Approximately 50% of the lands covered by the 1850 map were classified as "burned". The other half was covered with timber up to 200 years old. Not all of the tires that burned were stand replacement events. When comparing the 1850 map with the 1920 fire map, a majority of the original "burned areas" were later classified in 1920 as timber stands between 100 and 200 years old. This suggests that the fires caused only moderate damage to existing stands, many large mature trees survived, and a second story of conifers rapidly occupied the site.

The remainder of the "burned areas" on the 1850 map were later aged in 1920 as between 50-100 years. Seventy years after the 1850 fire events you would expect to see stands of this age class. These areas if previously timbered, probably were impacted by more intense stand replacement fires. These areas later became established from seed windblown from adjacent stands.

When comparing the 1850 map with the same coverage on the 1914 and 1920 maps, it is evident that in this WAU, fire activity was at much higher levels in the 1800's. The reasons for this may have to do with the amount of tire used by native Americans. It might have been associated with a much hotter, drier climatic pattern at the time. Since 1920, and the advent of modem fire suppression techniques, less catastrophic fues have occurred in the WAU

E. Lightning Strikes Since 1967

Records of tire starts in the Elk Cr. Watershed from 1967 thm 1995 are available on a database created by the Douglas Fire Protection Agency (DFPA). These records indicate that more than 300 fires occurred in the WAU over this period of time (Figure 3-6). Only 22 fires (7%) were on BLM lands. The majority of tires on BLM lands (15) were caused by lightning. Overall lightning caused fires accounted for approximately 16% of all starts (see lightning map). Human caused tires accounted for the majority of the starts. Because of rapid initial attack by the DFPA over 90% of these fires were less than 1 acre in size.

F. **Current Vegetation Age Class Distribution**

The East Elk 1996 Vegetation Habitat Types (Figure 3-2) was derived from several different sources and methods of photo interpretation. On federal lands the age classes are based on forest inventories with defined forest birthdates. In previous watershed analyses these age classes were placed into 7 different categories to better analyze the affects on wildlife. Because of the lack of data for forest types on the large amounts of private lands in East Elk, this type of categorization was not possible. To do a direct comparison with the map from 1936 **(Figure J-l),** four main categories were developed from the existing information.

In the NW and SE portions of East Elk, an inventoty of vegetation types on private lands was developed using 1989 aerial photos. This inventory had not blen developed for most of the middle portions of East Elk when this analysis started. Satellite imagery from 1993 was used to fill this data gap. Vegetation types were placed into the four categories as shown on Figure 3-2. Since this information was developed from 1989 aerial photos and from 1993 satellite imagery, it can be assumed that some of these vegetative types have changed as a result of timber harvest on private lands from then until now. It has been observed that second growth stands on private lands (Mid Seral, 25 to 80 years of age) have been harvested in the last several years and may have converted 10% of the stands to the Early Se& stage (forest stands 0 to 25 years of age).

As can be seen from Chart 3-l much of the Late Seral habitat has been harvested over the past 60 years and agriculture/pasture lands have been converted to growing trees. This has greatly increased the amount of Early and Mid Seral habitat types. This will probably remain the same over the coming years as private timber stands are usually harvested commercially between the ages of 40 and 60 years.

1. **Late Seral** Habitat and Old Growth - SO+ years and 120 years

There is approximately 8,889 acres of Late Seral type habitat which makes up about 7% of the East Elk WAU (Table 3-2). The majority of LSH (approximately 7,782 acres, **Table 33) occurs on federal ownership.** If it has not been harvested, approximately 1,107 acres of late successional forests remain on private lands. Since 1936 Late Seral stands have decreased by 27% **(Table 3-1 and 3-2).**

On federal lands, Late Seral Habitat (LSH) has been divided into two age classes which represent different levels of development of old growth characteristics. In general, stands between SO and 120 years of age in this WAU contain vigorous, mature trees with diameters typically over 20", some understory development and moderate amounts of snags and down wood. These types of stands are described in the Resource Management Plan as being in the maturation stage.

Stands with ages over 120 years typically contain larger trees with open, irregular crowns and thick, furrowed bark. The broken, dead and decayed portions of these trees provide habitat niches for many of the old growth dependent species of plants and animals. Large snags are common in stands of this age and down wood is generally abundant. Stands in this age class provide refugia for many threatened and sensitive species and provide the major contribution of coarse wood recruitment to stream channels. This stage is referred to as the transition stage.

2. Mid Seral Habitat - 25-80 years old

There is approximately 66,759 acres of Mid Seral type habitat which makes up about 52% of the East Elk WAU (as stated above harvesting may have lowered this amount by 10%). This is an increase of 17% from 1936 and probably is B result of stands that were harvested in the early 1900's or were burned from tire and naturally restocked. Stands of this age are mostly located on private ownership. On federal lands stands that have reached this age are frequently targeted for commercial thinning harvests. This has the effect of accelerating tree growth by removing competition. The objective of accelerating the development of LSH is often referred to when conducting treatments of this kind, especially in riparian and other reserve areas to enhance connectivity.

3. Early Seral Stage - O-25 years old

Approximately 23% (29,358 acres) of the WAU currently is in Early Seral stages known as grass/forb and shrub stages. This is an increase of about 11% since 1936 and the amount may be larger as a result of recent harvesting. Typically, these are regeneration harvest units that have been restocked with nursery seedlings from various sources. They may contain various amounts of hardwood species, either as residual trees from the previous stand or as new growth. Residual conifer components vary with the type of treatment used during harvest. In general, few if any residual old growth conifers remain on private harvest units. On federal lands, harvest prescriptions in the past ten years have required an average of 1.2 green trees per acre to be retained. However, many of these green trees were subsequently lost from the units due to slash burning and windthrow. The resulting new stands have a minimal number of residual old growth type trees.

4. **Agriculture/Pasture Lands**

Agriculture lands make up approximately 24,244 acres (19%) of this WAU which is a decrease of 10% since 1936. It is theorized that these changes are from pastore land being converted to growing commercial trees. Most of the current agriculture lands are thought to be used for grazing.

G. Plant Community Zones

The East Elk analysis area includes parts of three large vegetation 'provinces'.(Franklin and Dymess, 1984) These are the Coast Range province (the western drainages of the area), the Western Cascades province (the eastern drainages), and the Willamette Valley province which includes the interior valley drainages. These three provinces represent broad scale vegetation type groups. These groups reflect the underlying geology and soil types to a great extent.

A more detailed plant community analysis of the area was presented **in** 1994 by Gene Hickman of the Natural Resource Conservation Service. The results of several years of vegetation plot sampling for the Douglas Area Soil Survey indicate that the three provinces in the analysis area can be mapped in finer detail as actual vegetation zones or plant communities (Figure 3-7). Natural plant succession and stand development processes in these four zones differ.

1. Interior Western Hemlock Zone

This is a relatively small area in the northwestern and far eastern parts of the East Elk WAU. Western hemlock is the climax species in this zone and is the overstoly dominant on north aspects. It is usually present in minor amounts on south slopes, but may be absent in very dry conditions. This shade tolerant species generally develops good understory structure in a stand with a closed-canopy overstay. Douglas fir is an important secondary species throughout this zone and can become the dominant species in older forests on drier sites. Many previously harvested areas have been stocked with Douglas fir and thus have developed a uniform overstory of this species with an understory of hemlock. Grand fir is often an overstay or understory component. The presence of Grand fir in a stand allows for more rapid development of understory structure after a disturbance than could be expected in a stand with only western hemlock. This portion of the hemlock zone is typified by landscapes where temperature extremes and moisture stress are greater than in the coastal portion. Evergreen and deciduous shrubs are common in the understoly and can represent aggressive competition in regeneration efforts. Red alder is especially aggressive after fires on north slopes where it can soon dominate developing conifer stands.

2. Grand Fir Zone

This area forms a ring around the warm, interior valley. A small inclusion of this community type is located in the higher hills northeast of Drain. It represents a transition from the moist hemlock forests to the drier foothills of the interior. Douglas fir dominates most older stands in this zone, with Grand fir co-dominant or common on north aspects **and flat areas.** Both evergreen hardwoods, such as golden chinkapin and pacific madrone, and deciduous hardwoods such as California black oak are present in these stands and are an important element in the ecosystem, their mast (seeds. fruit and nuts) providing a valuable food resource to many vertebrates. Hardwoods form understory structures in openings in conifer stands, where many of the shade-tolerant conifer are absent. Grasses become more abundant on south aspects and hardwoods are favored over conifers in the droughty. clayey or wet soils. Near the transition to interior foothill zones salal, huckleberry and Grand fir drop out of the plant community even though many of the indicator plants for this community remain. White alder tends to replace red alder in this zone.

3. Interior Valley Zone

This area occupies the driest and warmest climatic areas in this analysis area. The area is composed of low hills and wide terraces and flood plains. Plants found in this zone arc similar to those found in the Willamette valley. Foothills with the most favorable soils have conifer forests of Douglas fir mixed with hardwoods such as row, California black oak and big-leaf maple. Other conifer species such as Ponderosa pine and incense cedar are also found interspersed in the stands. Bottomland vegetation has been influenced heavily by human development in the area. Native grasslands have been replaced by cultivated pastures and croplands and several large urban centers have been located here. A wide variety of native tree species occur in the bottomlands depending on site conditions. Oregon white oak and Oregon ash are found on poorly drained, clayey flood plains. Previous harvesting of conifers in this area has allowed the conversion of many foothill sites to hardwood-dominated stands. Clearing and burning have also reduced the extent of coniferous forests in this zone: Historically, once cleared pastures have also been reclaimed by oaklmadrone hardwood forests. Several large creek systems run through this zone and represent a sub-region with unique plant communities. Black cottonwood and California laurel are riparisn associates. Species of wildflowers and native grasses and herbs (as well as some wildlife species) are found in these low riparian habitats where they have persisted though the recent historic human development period. Site indexes for this area range from 124.146 feet per hundred yeas.

H. Special Status Plants

The following is a list of survey and manage and protection buffer species that may occur in this WAU. The number beside the plant name refers to the ROD page number and the survey strategies required:

		Paw No.	Strategv
Fungi:	Oxypoms nobilossimus	c54	1,2,&3
	Rhizopogon truncatw	c49	3
	Cantharellus cibarius	C51	3&4
	Cantharellus subalbidus	c51	3&4
	Cantharellus rubaefonnis	c51	3&4
	Gautieria otthii	c49	3
	Otidea leporina"	c54	3
	Otidea onotica"	c54	3
	Otidea smithii"	c54	l&3
	Aleuria rhenana"	c54	IL43
Liverworts:	Marsupella emarinata (var. aquatica)	c59	l&2
	Ptilidium califomicum	c59	l&2
Lichens:	Pseudocyphellaria rainierensis	C56	1,2,&3
	Hypogymnia duplicata	C56	1,2,&3
	Nephmma occultun	C56	I&3
	Usnea longissima	c57	4
Vascular Plants:			
	Allotmpa virgata	C60	l&2
	Cypripedium montanum	C6l	l&2
	Cypripedium fasciculatum	C61	l&2
	Aster vialis	C60	l&2
	Bensoniella oregana	C60	l&2
Bryophytes:	Buxbaumia piperi"	C58	l&3
	Buxbaumia vi&c	C58	l&3
	Rhizonmiun nudum"	C58	l&3
	Ulota meglospora"	C58	l&2
	Tetmphis geniculata"	c59	l&3
	Brotherella roelli	C58	l&3
	Ptilidiun califomicwn"	C58	l&2

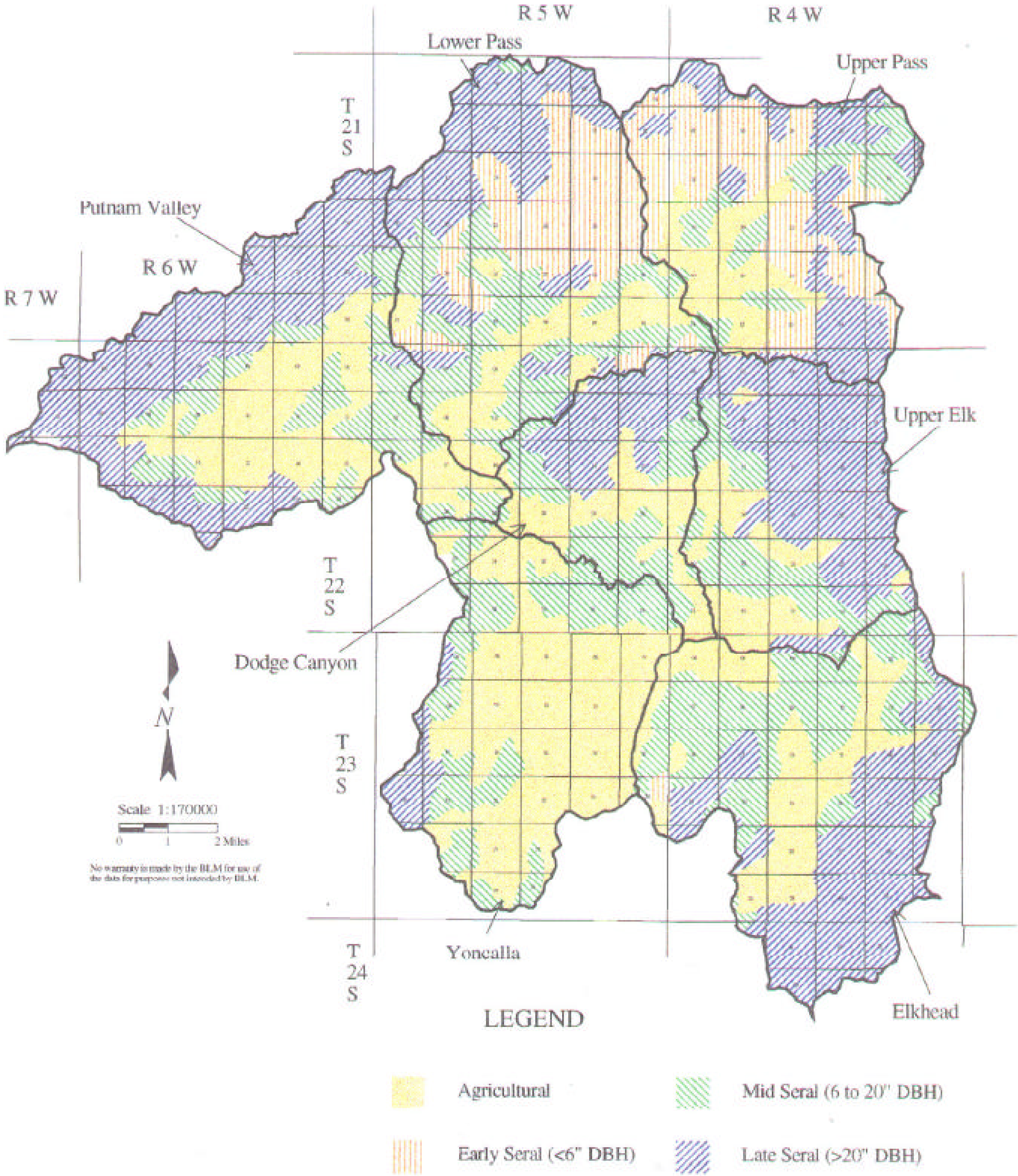
') Indicates species to be protected through protection buffers, Appendix H, Table H-2, page 187

All known Special Status Plant locations are shown on Figure 3-8. All have been verified except for Sidalcea cusickii in Section 22, T.23 S., R.5 W., which was located several years ago but has not been located since. Habitat that might support Special Status Plants could be identified in the future, probably at the project level.

I. Noxious Weeds

Figure 3-9 shows the known Scotch Broom locations that have been observed. This is not a complete map as Scotch Broan is known to occur along most of the major road system in the Roseburg District. In addition, though not verified or mapped, there are probably infestations of Tansey ragwort and 3 to 5 types of ODA category "B" thistles along the same major road ways in this WAU, although not as extensive as Scotch Broom. A data gap exists here as the mad system should be driven and locations of infestations mapped.

East Elk 1936 USFS Habitat Types



EAST ELK 1936
EARLY, MID, LATE SERAL AGE CLASSES & AGRICULTURE
(According to 1936 USFS Type Maps)

Drainages	LAND TYPES & SERAL AGE CLASSES (by diameter class - DBH)								TOTAL
	Agriculture		0 to 6" DBH		6 to 20" DBH		> 20" DBH		
Subwatersheds	(acres)	%	Early Seral (acres)	%	Mid-Seral (acres)	%	Late Seral (acres)	%	ACRES
30 Elk	1801	58%	0	0%	1172	37%	159	5%	3132
McClintock	991	30%	0	0%	1558	48%	703	22%	3252
Wehmeyer	261	7%	24	1%	491	14%	2811	78%	3587
Dodge Camp	3053	31%	24	0%	3221	32%	3673	37%	9971
Adams	938	23%	166	4%	2045	51%	853	21%	4002
E. Milltown	472	52%	0	0%	440	48%	0	0%	912
Elkhead	465	41%	0	0%	28	2%	634	56%	1127
Elkhead Mines	403	18%	0	0%	325	15%	1491	67%	2219
Milltown	1842	41%	1923	42%	726	16%	45	1%	4536
N. Milltown	247	42%	0	0%	295	50%	46	8%	588
Shingle Mill	6	0%	0	0%	0	0%	3768	100%	3774
Walker	1384	25%	0	0%	2147	39%	1957	36%	5488
Elkhead	5757	25%	2089	9%	6006	27%	8794	39%	22646
Ellenburg Cr	88	4%	329	17%	508	26%	1036	53%	1961
Fitch Cr	668	23%	541	19%	1183	41%	527	18%	2919
Little Sand	33	1%	1834	54%	335	10%	1177	35%	3379
Lower Pass	1281	37%	11	0%	1747	51%	380	11%	3419
Middle Pass	1369	40%	419	12%	1425	41%	241	7%	3454
Rock Cr	254	7%	2539	67%	58	2%	955	25%	3806
Sand Cr	49	1%	777	22%	687	19%	2074	58%	3587
Lower Pass	3742	17%	6458	29%	5943	26%	6390	28%	22525
Drain	1558	47%	0	0%	1728	53%	0	0%	3286
Hardscrabble	1311	24%	4	0%	1686	31%	2487	45%	5488
Indian Cr	2	0%	0	0%	18	1%	1997	99%	2017
Jack Cr	1647	41%	0	0%	410	10%	2006	49%	4063
Lancaster Cr	144	9%	73	5%	211	13%	1189	74%	1617
Middle Elk	935	60%	0	0%	218	14%	401	26%	1554
Parker Cr	273	8%	0	0%	697	22%	2243	70%	3213
Sunnydale	1437	49%	0	0%	508	17%	981	34%	2926
Putnam Valley	7307	30%	77	0%	5474	23%	11304	47%	24164
Cox Cr	679	20%	0	0%	472	14%	2286	67%	3437
Curtis Cr	254	11%	0	0%	171	7%	1873	82%	2298
Lee's Cr	6	0%	0	0%	176	8%	1951	91%	2133
Scotts Valley	1469	37%	0	0%	1753	44%	777	19%	3999
Thiel Cr	548	19%	0	0%	640	22%	1657	58%	2845
Upper Elk	2956	20%	0	0%	3212	22%	8544	58%	14712
Bear Cr	600	17%	1538	45%	332	10%	982	28%	3452
Buck Cr	984	30%	639	19%	340	10%	1340	41%	3303
Pheasant Cr	748	18%	2475	59%	281	7%	682	16%	4186
Upper Pass	248	5%	1532	32%	1391	29%	1562	33%	4733
Ward Cr	377	22%	746	43%	294	17%	309	18%	1726
Upper Pass	2957	17%	6930	40%	2638	15%	4875	28%	17400
Cowan Cr	2059	96%	0	0%	97	4%	0	0%	2156
Devore Mtn	2599	55%	48	1%	1777	37%	338	7%	4762
Halo Cr	1698	50%	0	0%	1727	50%	0	0%	3425
Huntington Cr	1299	45%	0	0%	769	27%	790	28%	2858
Rice Hill	4567	80%	0	0%	1159	20%	0	0%	5726
Yoncalla	12222	65%	48	0%	5529	29%	1128	6%	18927
EAST ELK	37994	29%	15618	12%	32025	25%	44708	34%	130345

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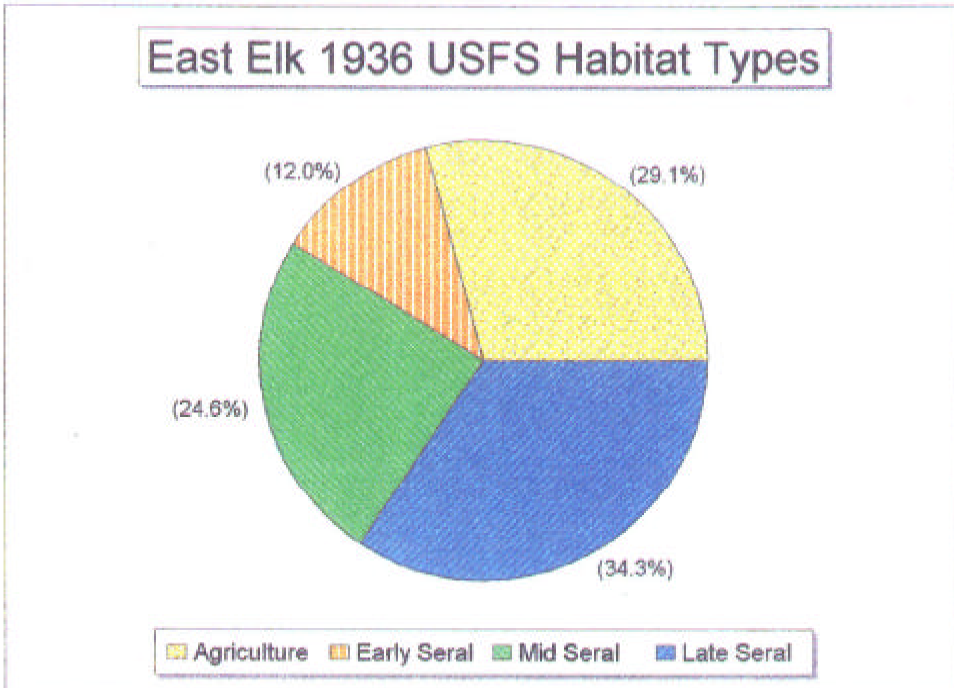
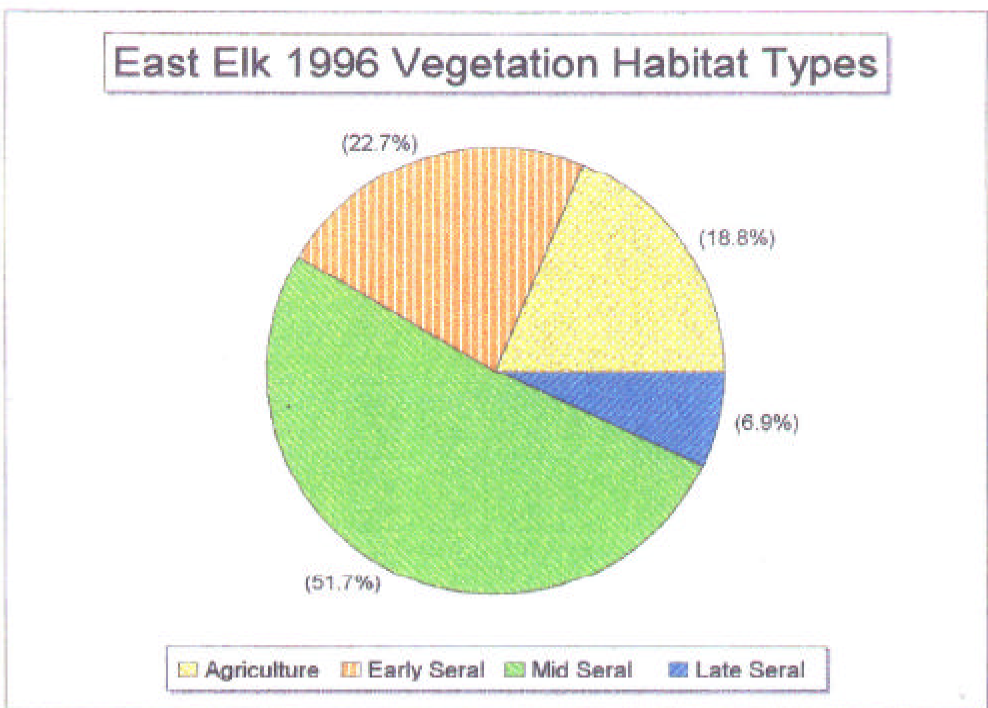
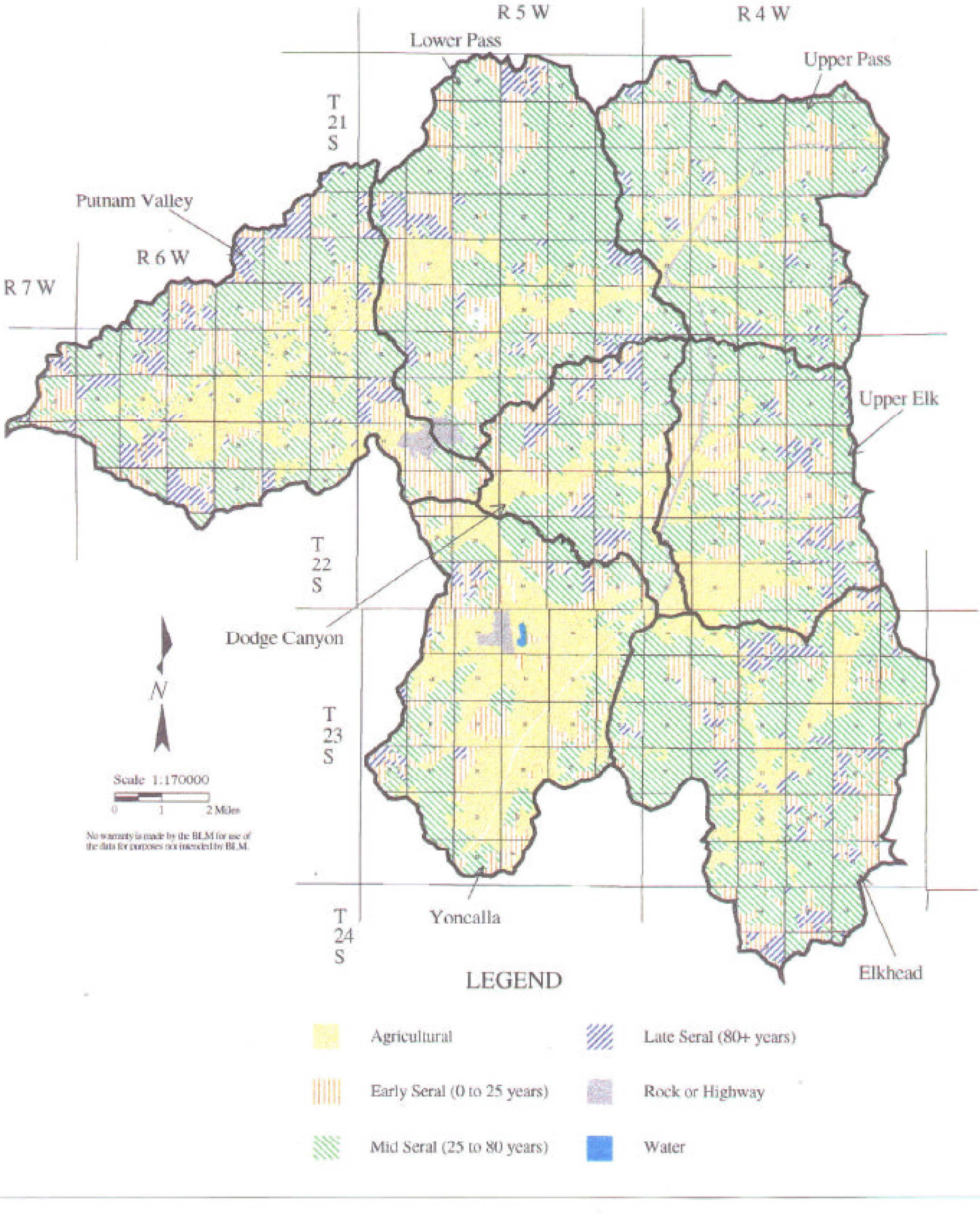

East Elk 1936 USFS Habitat Types
(12.0%)
(29.1%)
(24.6%)
(34.3%)
Agriculture
Early Seral
Mid Seral
Late Seral


East Elk 1996 Vegetation Habitat Types
(22.7%)
(18.8%)
(6.9%)
(51.7%)
Agriculture
Early Seral
Mid Seral
Late Seral

East Elk 1996 Vegetation Habitat Types



EAST ELK 1996 VEGETATION HABITAT TYPES
Early, Mid, & Late Seral Age Classes & Agriculture
(According to 1989 & 1993 aerial & satellite photos on private lands, Forest Inventory on Federal lands)

	LAND TYPES & SERAL AGE CLASSES								
Drainages	Agriculture Lands		Early Seral (0-25 yrs)		Mid Seral (26-80 yrs)		Late Seral (80+ yrs)		TOTAL
Subwatersheds	acres	%	acres	%	acres	%	acres	%	ACRES
30 Elk	1165	37%	639	20%	1181	38%	145	5%	3130
McClintock	726	22%	893	27%	1368	42%	265	8%	3252
Wehmeyer	91	3%	1002	28%	2141	60%	355	10%	3589
Dodge Camp	1982	20%	2534	25%	4690	47%	765	8%	9971
Adams	372	9%	473	12%	3055	76%	103	3%	4003
E. Milltown	191	21%	17	2%	689	76%	14	2%	911
Elkhead	309	27%	182	16%	483	43%	153	14%	1127
Elkhead Mines	274	12%	765	34%	954	43%	230	10%	2223
Milltown	1117	25%	711	16%	2382	53%	325	7%	4535
N. Milltown	259	44%	51	9%	214	36%	65	11%	589
Shingle Mill	35	1%	977	26%	2343	62%	419	11%	3774
Walker	982	18%	817	15%	3285	60%	406	7%	5490
Elkhead	3539	16%	3993	18%	13405	59%	1715	8%	22652
Ellenburg Cr	397	20%	448	23%	656	33%	460	23%	1961
Fitch Cr	541	18%	1156	38%	1253	41%	77	3%	3027
Little Sand	168	5%	740	22%	2274	67%	198	6%	3380
Lower Pass	444	14%	860	27%	1843	57%	86	3%	3233
Middle Pass	660	19%	747	22%	1664	48%	383	11%	3454
Rock Creek	183	5%	303	8%	3217	85%	104	3%	3807
Sand Cr	201	6%	772	22%	2542	71%	72	2%	3587
Lower Pass	2594	12%	5026	22%	13449	60%	1380	6%	22449
Drain	587	19%	1217	40%	1003	33%	212	7%	3019
Hardscabble	826	15%	882	16%	3032	55%	747	14%	5487
Indian Cr	86	4%	440	22%	1217	60%	272	13%	2015
Jack Cr	851	21%	654	16%	2060	51%	498	12%	4063
Lancaster Cr	86	5%	360	23%	905	57%	247	15%	1598
Middle Elk	408	27%	165	11%	865	56%	97	6%	1535
Parker Cr	278	9%	1017	32%	1456	45%	462	14%	3213
Sunnydale	956	33%	390	13%	1134	39%	423	15%	2903
Putnam Valley	4078	17%	5125	22%	11672	49%	2958	12%	23833
Cox Cr	212	6%	1205	35%	1701	49%	320	9%	3438
Curtis Cr	216	9%	1042	45%	829	36%	212	9%	2299
Lee's Cr	163	8%	384	18%	1432	67%	154	7%	2133
Scotts Valley	1623	41%	686	17%	1460	37%	216	5%	3985
Thiel Cr	239	9%	931	34%	1513	56%	27	1%	2710
Upper Elk	2453	17%	4248	29%	6935	48%	929	6%	14565
Bear Cr	225	7%	954	28%	2142	62%	130	4%	3451
Buck Cr	204	6%	443	14%	2389	73%	224	7%	3260
Pheasant Cr	251	6%	1227	29%	2529	61%	171	4%	4178
Upper Pass	210	4%	1266	27%	3219	68%	37	1%	4732
Ward Cr	130	8%	600	35%	894	52%	89	5%	1713
Upper Pass	1020	6%	4490	26%	11173	64%	651	4%	17334
Cowan Cr	1380	66%	248	12%	463	22%	0	0%	2091
Devore Mtn	1744	39%	1302	29%	1225	27%	195	4%	4466
Halo Cr	1349	39%	732	21%	1234	36%	110	3%	3425
Huntington Cr	884	31%	713	25%	1076	38%	186	7%	2859
Rice Hill	3221	57%	947	17%	1437	26%	0	0%	5605
Yoncalla	8578	47%	3942	21%	5435	29%	491	3%	18446
EAST ELK	24244	19%	29358	23%	66759	52%	8889	7%	129250

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EAST ELK 1996 VEGETATION HABITAT TYPES
Early, Mid, & Late Seral Age Classes
(Federal Lands Only, Forest Inventory)

Drainages / Subwatersheds	Early Seral (0-25 yrs) acres	Early Seral %	Mid Seral (26-80 yrs) acres	Mid Seral %	Late Seral (80+ yrs) acres	Late Seral %	TOTAL ACRES
30 Elk	125	46%	0	0%	145	51%	270
McClintock	21	7%	1	0%	265	92%	287
Wehmeyer	325	45%	43	6%	355	49%	723
Dodge Camp	471	37%	44	3%	765	60%	1280
Adams	222	20%	815	72%	91	8%	1128
E. Milltown	14	11%	116	89%	0	0%	130
Elkhead	164	33%	210	42%	124	25%	498
Elkhead Mines	280	41%	239	35%	169	25%	688
Milltown	429	48%	282	32%	184	21%	895
N. Milltown	0	0%	11	23%	37	77%	48
Shingle Mill	526	31%	733	44%	415	25%	1674
Walker	462	35%	514	39%	344	26%	1320
Elkhead	2097	33%	2920	46%	1364	21%	6381
Ellenburg Cr	62	16%	71	18%	253	66%	386
Fitch Cr	55	22%	117	47%	77	31%	249
Little Sand	43	15%	38	14%	198	71%	279
Lower Pass	50	26%	53	28%	87	46%	190
Middle Pass	139	22%	113	18%	384	60%	636
Rock Creek	123	38%	95	30%	104	32%	322
Sand Cr	18	21%	0	0%	68	79%	86
Lower Pass	490	23%	487	23%	1171	55%	2148
Drain	4	2%	11	6%	180	92%	195
Hardscabble	204	17%	404	34%	584	49%	1192
Indian Cr	95	13%	342	49%	268	38%	705
Jack Cr	69	10%	184	26%	455	64%	708
Lancaster Cr	128	30%	52	12%	247	58%	427
Middle Elk	4	5%	0	0%	80	95%	84
Parker Cr	494	45%	202	18%	399	36%	1095
Sunnydale	324	46%	26	4%	361	51%	711
Putnam Valley	1322	26%	1221	24%	2574	50%	5117
Cox Cr	314	30%	441	42%	285	27%	1040
Curtis Cr	291	38%	296	39%	181	24%	768
Lee's Cr	143	17%	557	65%	154	18%	854
Scotts Valley	5	1%	139	39%	216	60%	360
Thiel Cr	77	25%	199	66%	27	9%	303
Upper Elk	830	25%	1632	49%	863	26%	3325
Bear Cr	51	7%	581	80%	92	13%	724
Buck Cr	0	0%	459	70%	201	30%	660
Pheasant Cr	19	3%	543	74%	168	23%	730
Upper Pass	37	80%	5	11%	4	9%	46
Ward Cr	42	12%	208	61%	89	26%	339
Upper Pass	149	6%	1796	72%	554	22%	2499
Cowan Cr	0	0%	0	0%	0	0%	0
Devore Mtn	194	49%	7	2%	195	49%	396
Halo Cr	99	46%	8	4%	110	51%	217
Huntington Cr	171	35%	127	26%	186	38%	484
Rice Hill	0	0%	0	0%	0	0%	0
Yoncalla	464	42%	142	13%	491	45%	1097
EAST ELK	5823	27%	8242	38%	7782	36%	21847

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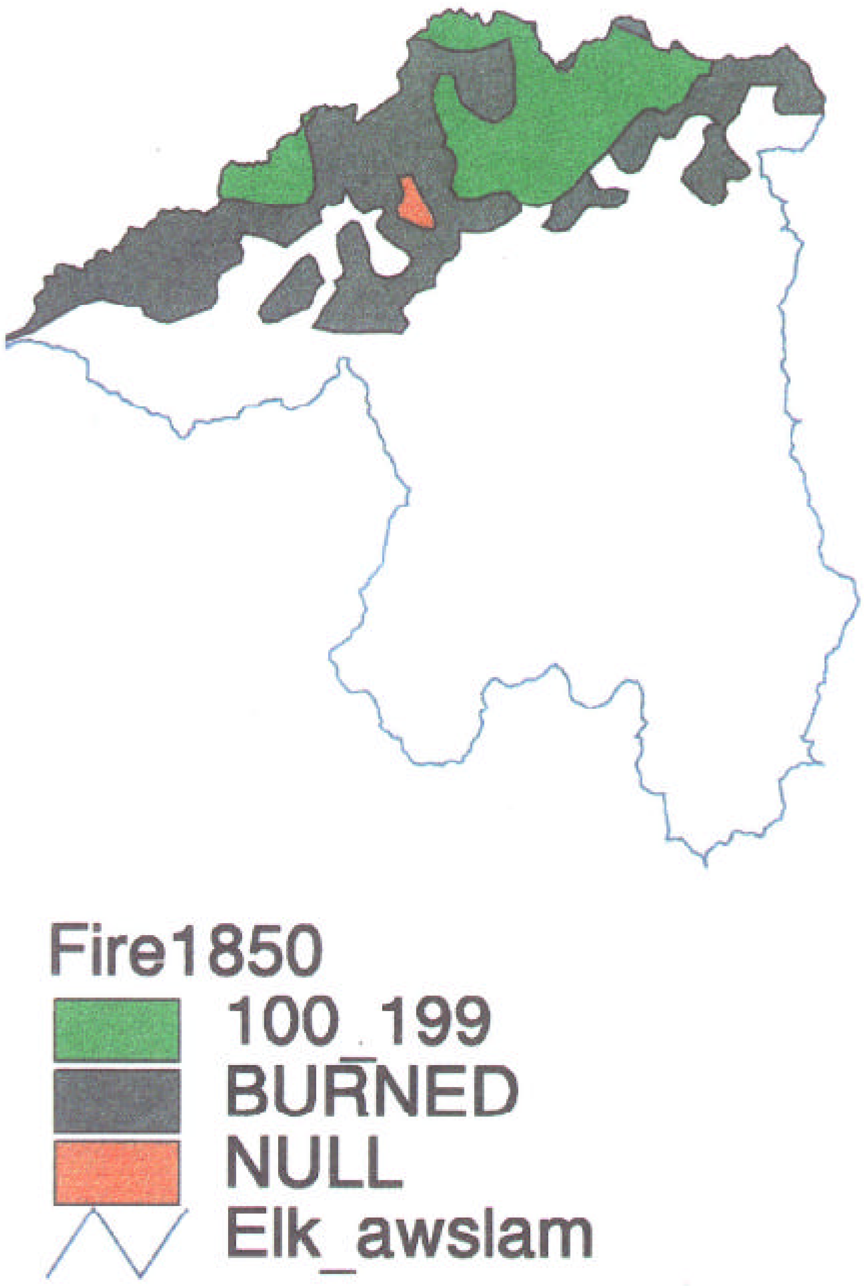
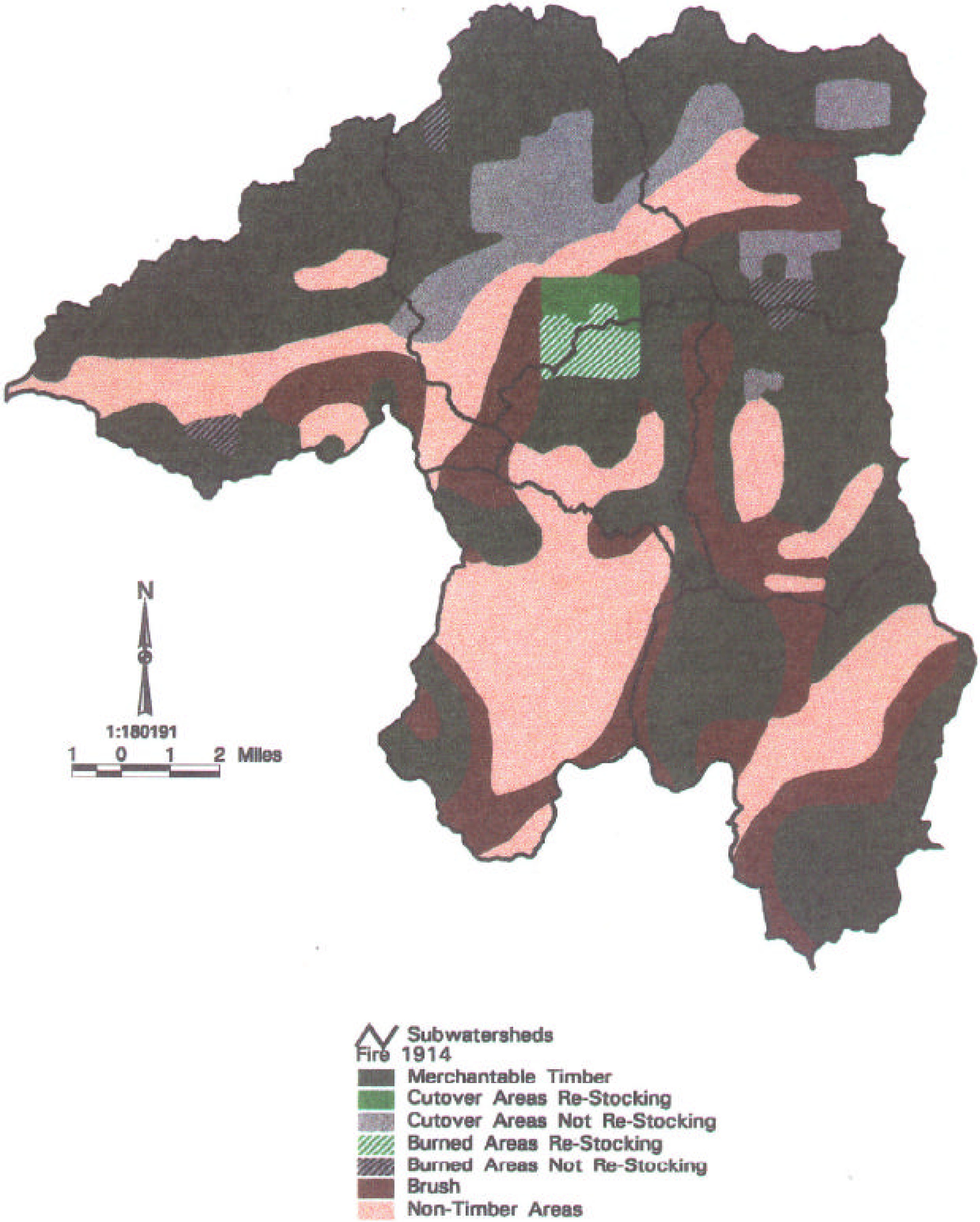
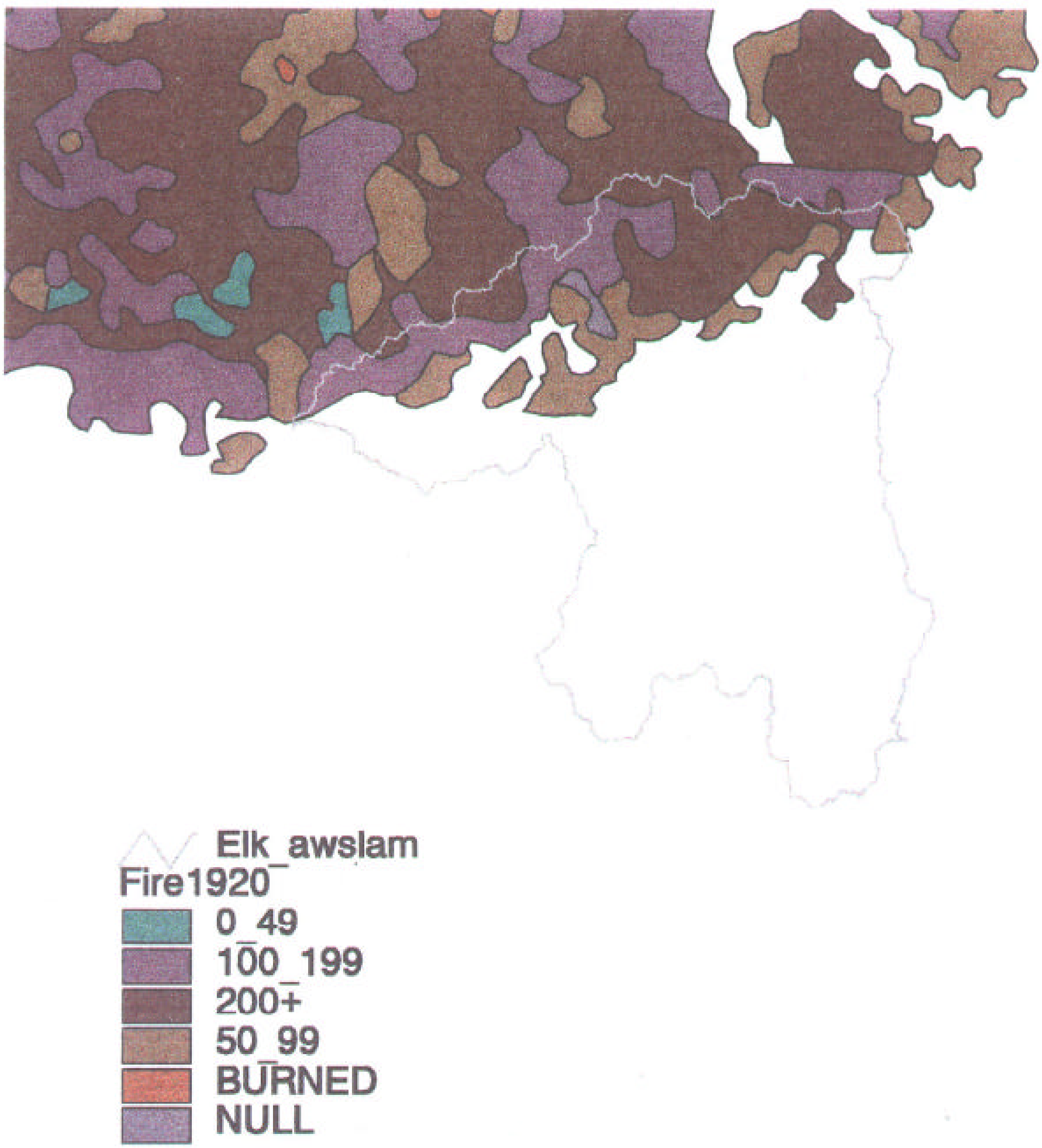
EAST ELK 1850 FIRE MAP



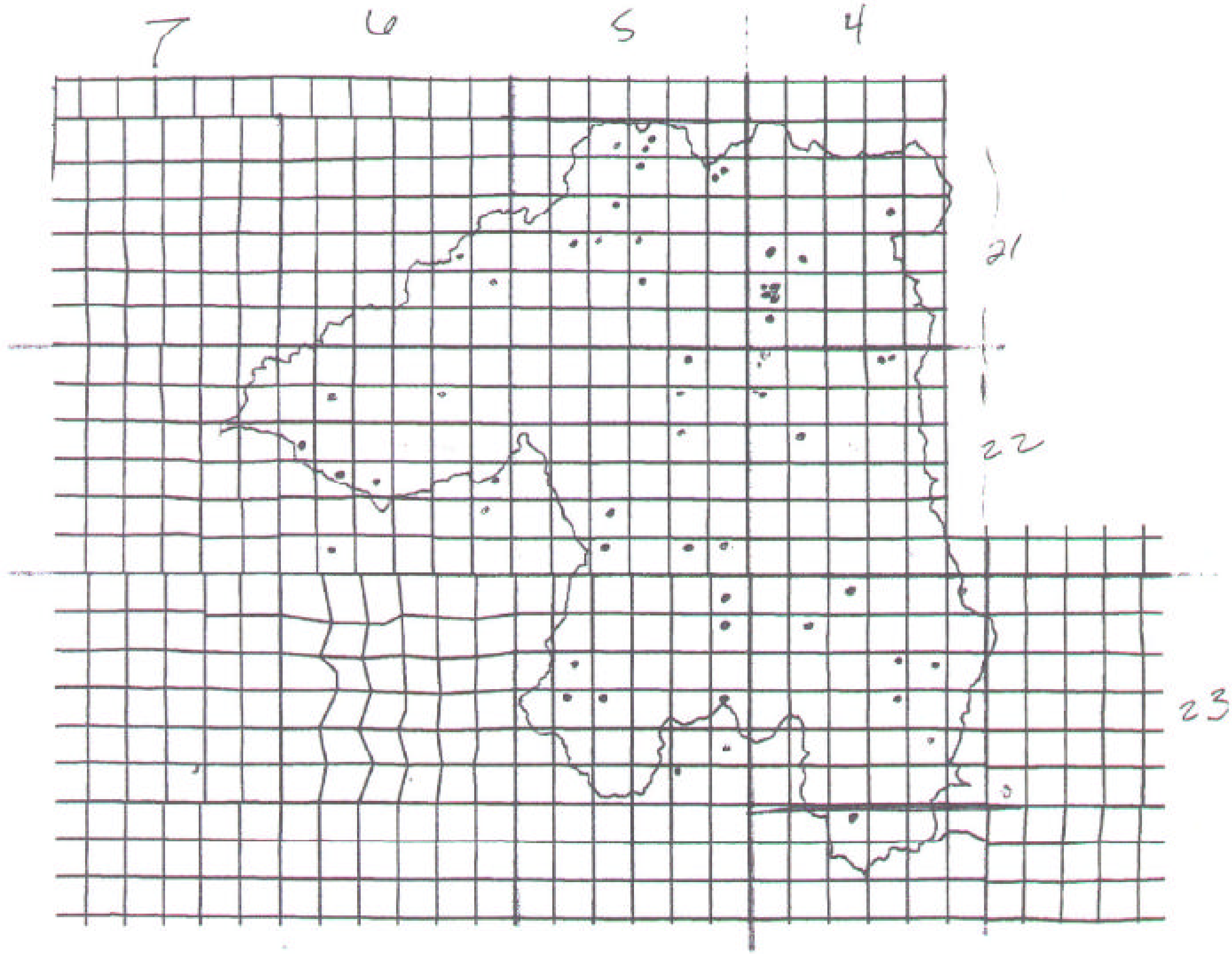
Elk Creek 1914 Fire Map



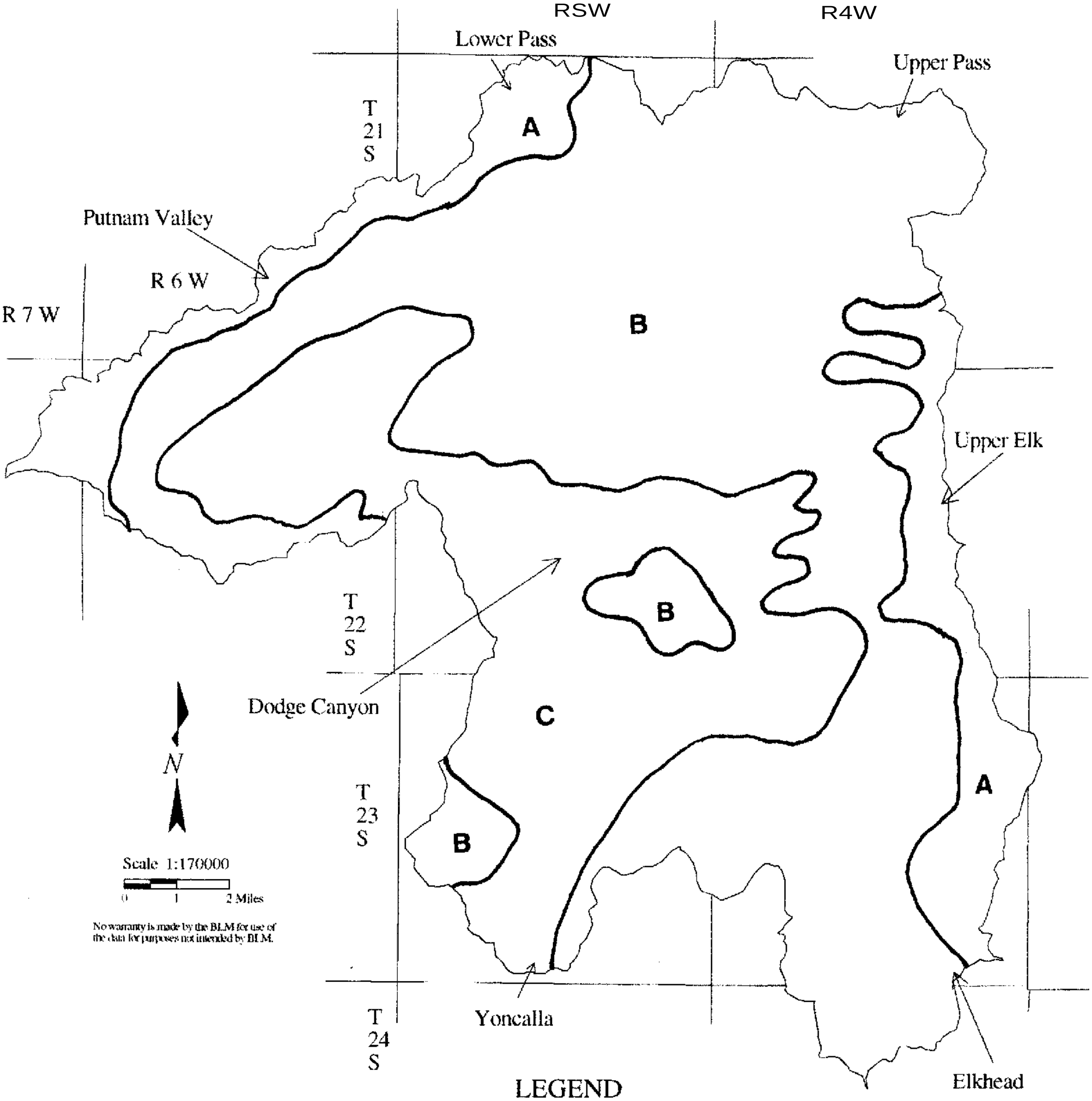
EAST ELK 1920 FIRE MAP



EAST ELK LIGHTNING STRIKES (SINCE 1967)



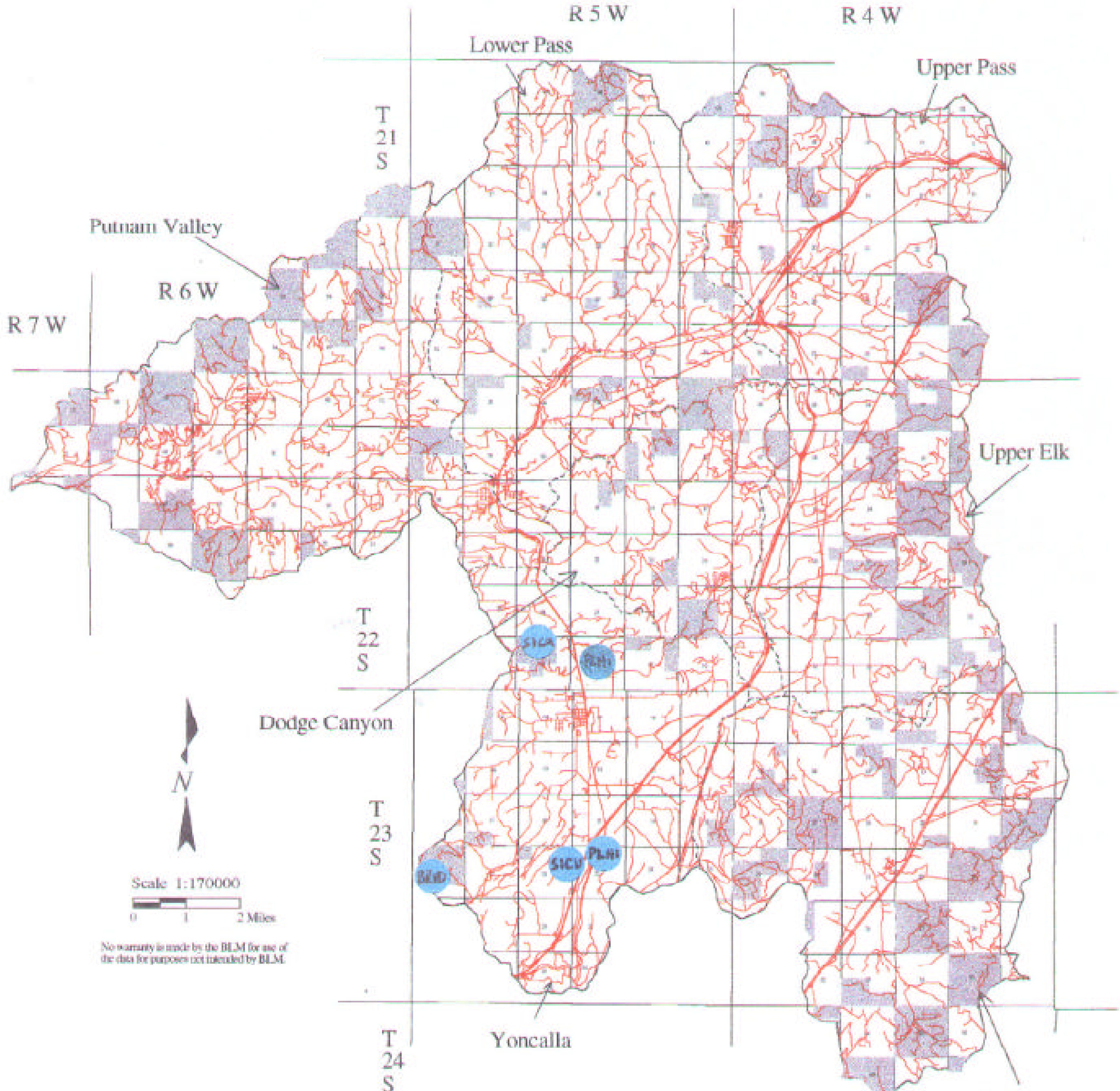
Plant Community Zones



LEGEND

A	Western Hemlock Zone – Interior Phase
B	Grand Fir Zone
C	Interior Valley and Foothill Zone

East Elk Special Status Plant Locations



LEGEND

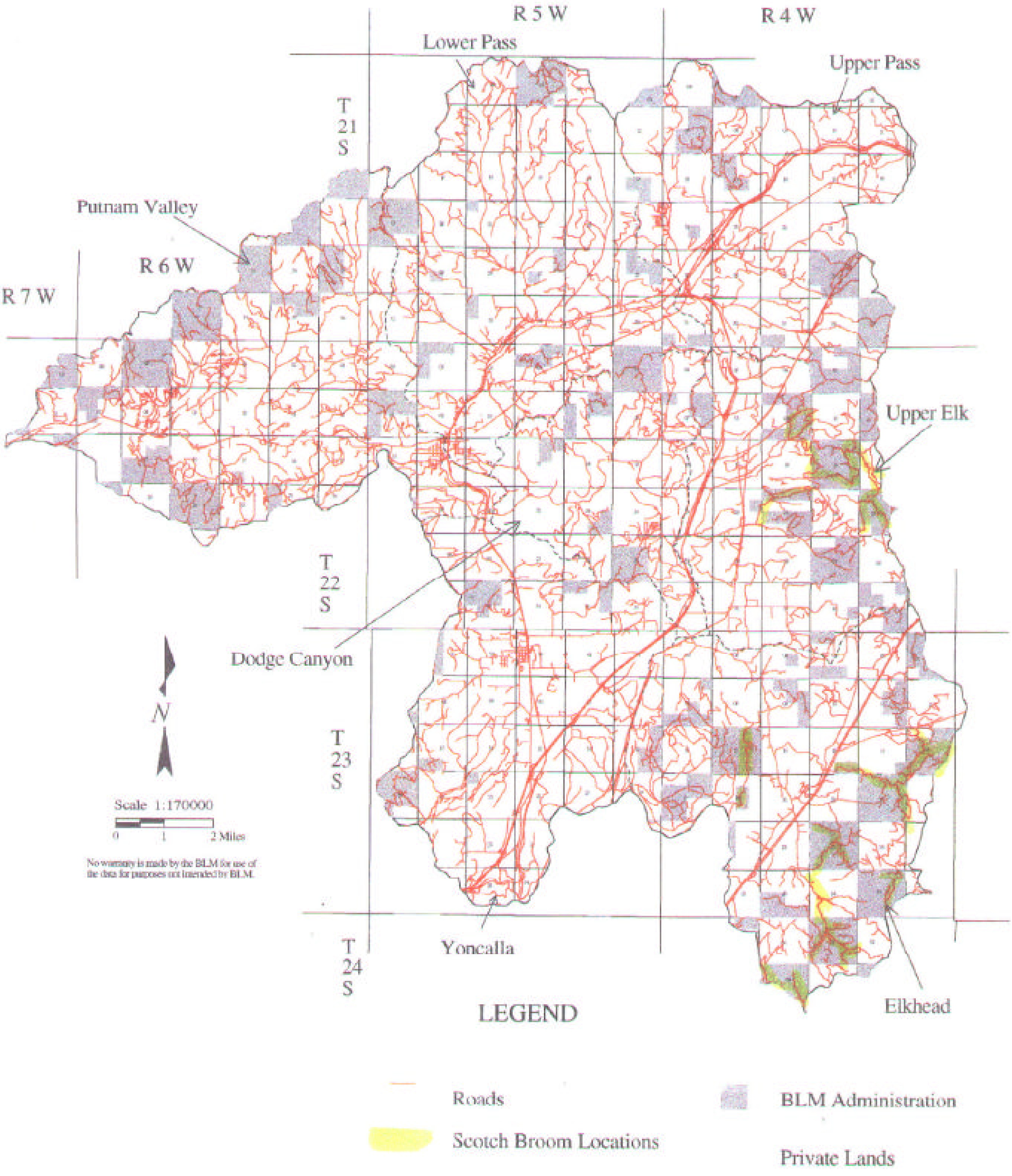
Roads

Special Status Plant Locations

BLM Administration

Private Lands

East Elk Noxious Weed Locations



WILDLIFE HABITAT AND SPECIES

A. Introduction

The President's Forest Plan currently provides a" adequate strategy for conservation and viability for species that are dependent on LSH but are not on the list of species in Table C-3 of the ROD. Examples include the northern spotted owl, pile&d woodpecker, tailed fmg and bald eagle. The wccess of this conservation strategy is dependent on the integrity and composition of the rexwe system, the riparian reserves, the LSR and connectivity sections and other reserves designated for special status species and natural areas. Current habitat conditions in the reserve system and its functionality are described later in this section. This analysis, together with the aquatic section analysis provides a body of information on which to base decisions concerning adjustments of the riparian reserve boundaries. Distribution of occummce for many of special stahls species is **known to varying** degrees, and the reader will refer to wildlife biologists records in local databases for this information. Observation locations for several special statlls species recorded in this drainage are illustrated in Figure 4-l. Although many sensitive species listed as threatened or endangered occur in this WAU **(Table 4-l),** it is not the role of this document to further analyze the impacts of the forest plan on them. Instead it seeks only to describe special land use designations where they are included for specific protection of these animals and to explain the firnctions of these areas.

Other species for which the forest plan was not considered adequate will require further evaluation. Species listed in Table C-3 of the ROD are dependent on LSH but were not considered to be adequately protected by the plan. Specific recommended mitigation measures will be described in the Environmental Assessment at the project planning stage. Implementation of those measures may be appropriate based on detailed site specific information available at that time. Dispersal habitat for northern spotted owls was not considered in the ROD and also merits funher evaluation in this analysis.

B. Key Concerns

There are two major concerns to be addressed in this watershed analysis with regard to wildlife use in the drainage. These are 1) maintenance of Late Successional Habitat (LSH) and dispersal habitat for late successional species and 2) protection and improvement of rip&m and aquatic habitat in the Yoncalla subwatershed to ensure continued presence of viable populations of Western pond turtles, red-legged frogs and other special status wildlife species which depend on low elevation aquatic habitats such as those found in this vicinity.

C. **Federal Land Management for Wildlife Dependent on** LSH

Two factors make the East Elk WAU a" important region in which management of this habitat a high priority.

First, this WAU is located at the junction of three geographic provinces, the Coast Range, the Southern Cascades. and the Willamette Valley provinces. Genetic mixing of populations between these provinces depends to a large extent on the condition of the habitat in this WAU. The area has been identified as the Willametteil-5 Area of Concern for the owl due to its location in the landscape. Five Designated Critical Habitat ""its identified for dispersal functions are located in this WAU. Portions of a Designated Critical Habitat unit for Marbled Murrelet are also located in this WAU. These Designated Critical Habitat "nits can be see" in Figure 4-2. Providing dispersal opportunities in this region is essential to the wccess of the Forest **Plan** and to the recovery and future de-listing of the Northern Spotted OWL

Second, the region is not currently functioning well for dispersal of late successional species, such as northern spotted owls and neo-tropical birds. Relocation data of banded spotted owls has documented only five birds that have successfully moved from one province to another through this area since 1983. The major explanation for this lack of dispersal is the poor current habitat condition. The percentage of LSH has been drastically reduced since the early 1900's. Intensive timber harvest in the watershed combined with a large forest fire event in the late 1800's has effectively converted many thousands of acres of old timber to early successional or Mid Seral habitat. Currently there is only 7% of the WAU which contains forests older than 80 years of age. Another 52% is between 25 and 80 years old, much that on private lands, and possibly half of these stands may be functioning as dispersal habitat. **Figure 4-3** shows the dispersal habitat within East Elk WAU only on federal lands in relation to the surrounding habitat. If half of the Mid Seral age class, including private lands, were considered suitable dispersal habitat, then only 33% of the landscape is allowing passage of spotted owls during dispersal. (In reality, these numbers are probably an overestimate because of harvesting within the last few years as was stated earlier in the Vegetation section.)

Many of the areas that were burned or harvested in the past retained an element of residual trees of large diameter and natural regeneration took place. Seventy years later these stands are starting to function as LSH. Unforhmately, many of these areas are rapidly being harvested. Analysis shows that over 20% of this WAU was harvested between 1989 and 1994. Current good lumber markets combined with a fear of future restrictions due to environmental laws have caused many small landowners to harvest their forest lands rather than gamble on conditions in the future. The result is an accelerated decline in dispersal and suitable nesting and foraging habitat in the region.

Federal lands contain almost all of the cwent LSH (SO+ yrs) in this WAU. Of this habitat, 5,177 acres of this habitat (44% of federal lands, Table l-3; 4% of the entire WAU) is within some type of reserve on federal lands. The remainder is located on either General Forest Management Area or Connectivity as designated in the Roseburg District Resource Management Plan and are designated for timber harvest activities. Several subwatersheds (Upper Elk, Elkhead, Upper Pass) are key areas for dispersal and also contain some of the largest amounts of Mid Seral habitat within reserves (Chart l-3). Many of these stands could be developing into late successional type habitat within the next several decades. Deferring regeneration type harvests and planning special silvicultuml prescriptions for these lands is vitally important if this WAU is to function for spotted owls and other LSH species. Several of the successfully dispersing owls have originated in core areas located in these blocks of habitat. Managing the remaining old growth blocks in this WAU, locating restoration projects in these areas and protecting the functions that they currently have is a primary goal for wildlife in this WAU.

Approximately 45% of stands in the WAU of the 25 to 80 year age class (58,517 acres, **Table 3-2 and 3-3) are** located on private lands. Many of these stands are beginning to reach the late successional stage and function as dispersal habitat. Only 8,242 acres (6% of the WAU) of this Mid Seral habitat are on federal lands, of which 3,595 acres are in reserves (Table l-3). Management of these stands both inside and outside of reserves, though seemingly inconsequential in the big picture, should help develop stand structure toward better functioning dispersal habitat.

A more helpful approach, in terms of wildlife, would be to provide incentives for management of private lands in the area to reflect concerns for wildlife management. Currently the most useful area of connected dispersal habitat is across the northern portion of the East Elk WAU. This portion of the WAU has a large amount of second growth forests **(Figure 3-Z).** The majority belongs to one large timber company which is currently harvesting in the area. Scattered federal parcels throughout the Dodge Canyon and Yoncalla basins provide stepping stones across the large expanse of valley habitat between the foothills of the Cascades and the Coast ranges. Some second growth on private ownership located near these parcels currently provides dispersal opporhmities for some species such as migratory songbirds, large rapton and some mammals. Acquisition and management of this habitat by federal, state or county agencies could provide additional protection of dispersal capabilities of this WAU.

Education about federal restrictions and harvesting guidelines as well as about basic ecological principles may encourage many small landowners to retain their land in older forest types. Larger forest land corporations may benefit from coordination with federal agency biologists and managers so that their conservation plans will reflect some of these concerns. Perhaps timing and locations of harvests in the area could be arranged so that dispersal remains possible for spotted owls and other late successional creahxes across their ownership in this vital region.

D. Riparian Dependent Wildlife in Yoncalla Creek

A secondary concern in this WAU involves the presence of special statUs riparian dependent wildlife species in and around Yoncalla creek. These species depend on wetland habitat conditions adjacent to the stream and a number of old log ponds near the town of Yoncalla.

During a recent railroad accident near Yoncalla, B number of Western pond turtles and red-legged frogs were located in this basin. Both species have been listed as candidates for listing as federally threatened species. Western pond turtle populations are declining and numbers of juvenile turtles have been cited as the major demographic factor contributing to this decline. A number of environmental effects may be responsible for this lack of juveniles including

I) the introduction of bullfrogs and non-native fish into ponds who prey on young turtles, 2) a lack of suitable protected nesting habitat such as sandy soil adjacent to ponds and streams and safe from nest predators such as raccoons, skunks and domestic dogs and 3) development of pond and stream areas for intensive human use such as recreation and housing which would impact nesting habitat, reproductive success and dispersal of young turtles.

Red-legged frogs breed in permanent, shallow ponds which remain cool through April or until the tadpoles have metamorphosed. After leaving the breeding pools, the young frogs become terrestrial and spend the remainder of the year in moist ground cover which remains cool and shady. This species is highly dependent on riparian streamside vegetation and older forested habitats upland which can offer the cool, moist conditions that they require. A number of breeding ponds were located along Yoncalla creek, generally in shaded backwater areas which were separated from the main channel, but which retained sufficient water depth and cool temperature for rearing tadpoles. Maintenance of the current flow regime in these streams and protection of shading vegetation will help to keep these breeding pools functional. On the other hand, streamside urban and recreation development and loss of cool, moist riparian and upland vegetation will adversely impact this species due to dehydration mortalities and increased predation on terrestrial adults and juveniles.

Protection and management of riparian and aquatic habitats in the Yoncalla basin will depend almost entirely on private owners and state wildlife agencies. There is very little federal ownership in this basin and wetland water quality will not be affected to any great extent by federal land management. The proposal to construct a dam in the Elkhead basin and to divert water stored behind this dam to augment the flow in Yoncalla creek or replace water withdrawals from the creek could potentially improve the quality of streamside habitat. Again, coordination and education are the keystones to providing habitat for the special status species currently living in these wetlands.

Figure 4-1

Special Status Wildlife Species Observations

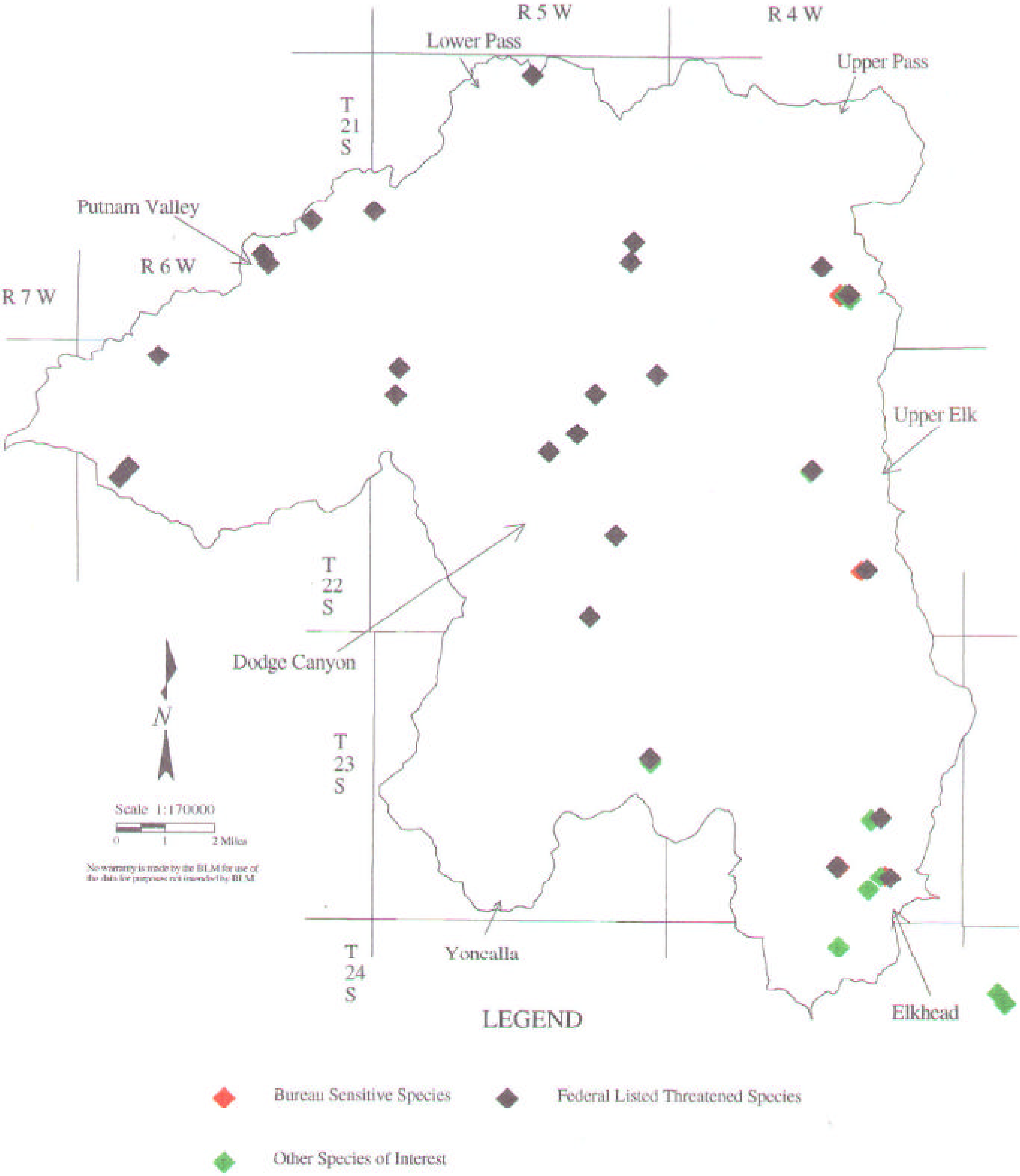


Table 4-1

Special Status Wildlife Species, East Elk WAU

Species	Status	Presence	Inventory
Peregrine Falcon	FE, ST	S	3
Bald Eagle	FT, ST	S	3
Northern Spotted Owl	FT, ST	D	4
Western Pond Turtle	FC, SC	D	3
Cascades Frog	FC, AS, SC	U	1
Long-eared Bat	FC	S	2
Red-legged Frog, Oregon Species	FC	D	3
Spotted Frog	FC, SU	U	1
Northern Goshawk	FC, AS, SC	S	3
Pileated Woodpecker	AS, SC	D	3
Mountain Quail	FC	D	3
Western Bluebird	AS, SV	D	1
Northern Pygmy Owl	SU	D	3
Northern Saw-whet Owl	AS	D	3
Western Meadowlark	AS	D	1
Purple Martin	AS, SV	D	1
Townsend's Big-eared Bat	FC, SC	S	2
Yuma Myotis Bat	FC, SC	S	2
Fringed Myotis Bat	FC, SV	S	2
Pine Martin	AS, SC	S	1
Ringtail	SU	U	3
Clouded Salamander	AS, SC	D	3
Tailed Frog	FC, SV	U	3
Long-legged Bat	FC, SC	S	2
California Mountain Kingsnake	AS, SP	S	2
Common Kingsnake	AS, SP	D	2
Sharptailed Snake	AS, SV	D	3
Vertree's Ceraclean Caddisfly	FC	U	1
Vertree's Ochotrichian Microcaddisfly	FC	U	1
Mt. Hood Primative Brachycentrid Caddisfly	FC	U	1
Oregon Snail	FC	U	1
Oregon pearly mussel	FC	U	1

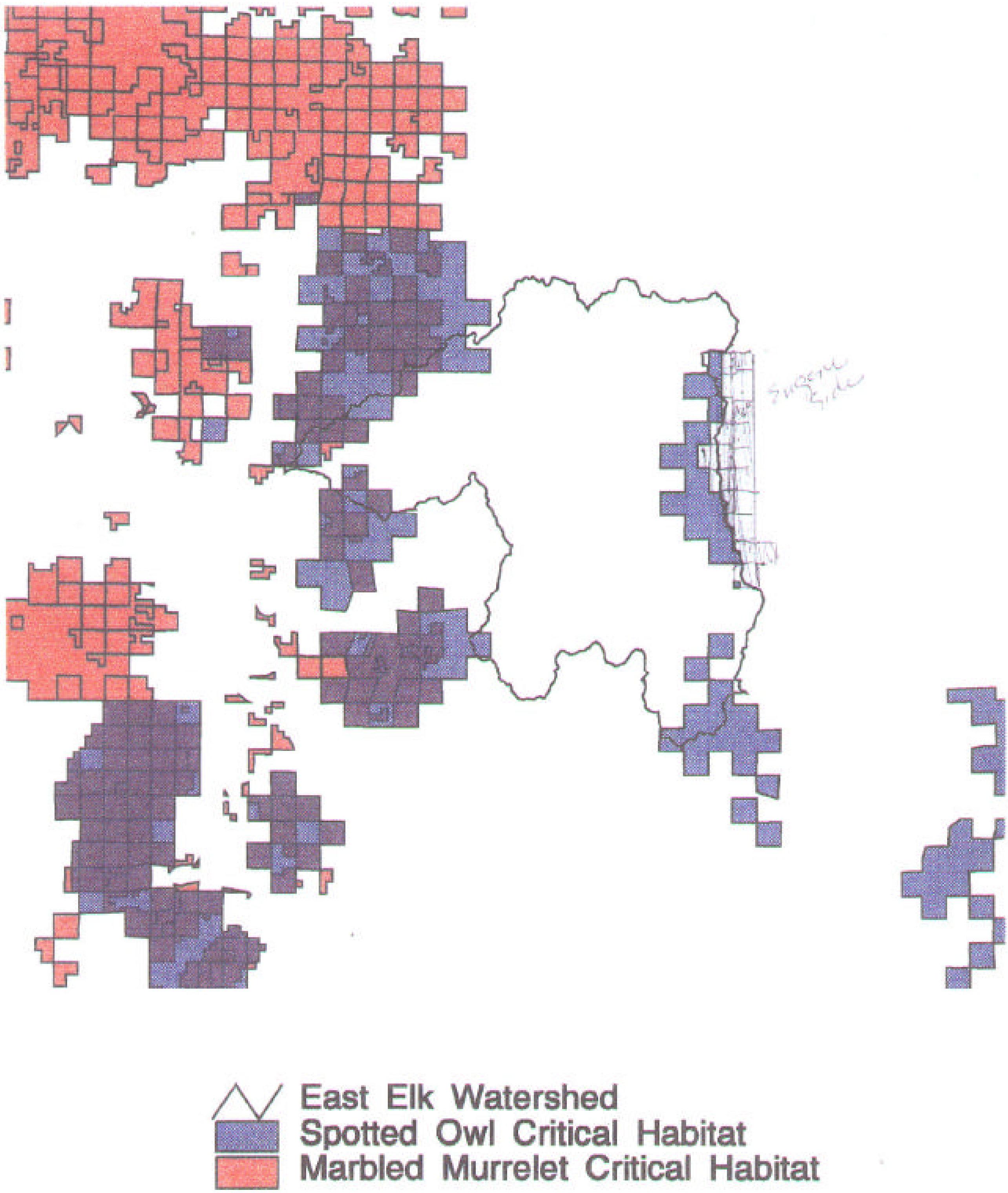
C&o Sahm"	FP	D	3
Sea-run coastal cutthroat	FP	D	3
Winter steelhead	FP	D	3

SfdW
FE Federal Endangered
FT Federal Threatened
FP - Federal Pmpased
FC Fed& Candidate
BS Bureau Sensitive
AS Assessment Species (KM)
SE State Endangered
ST State Threatened
SC - State Critical
SP State Peripheral or naturally rare
S" State Vulnerable
S" - State Undetermined

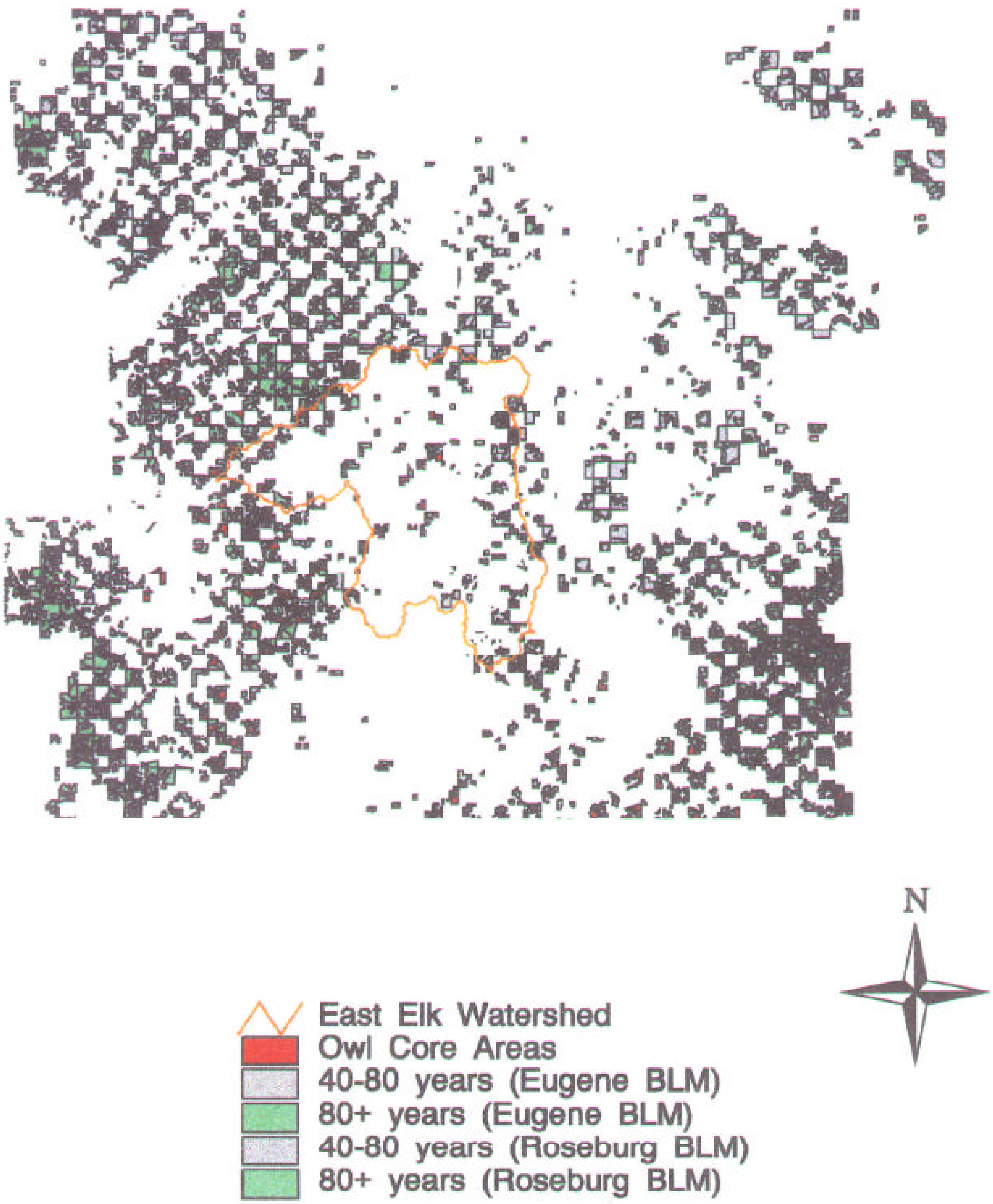
Presence:
D - Documented
S - Suspected
U - Uncertain
A - Absent

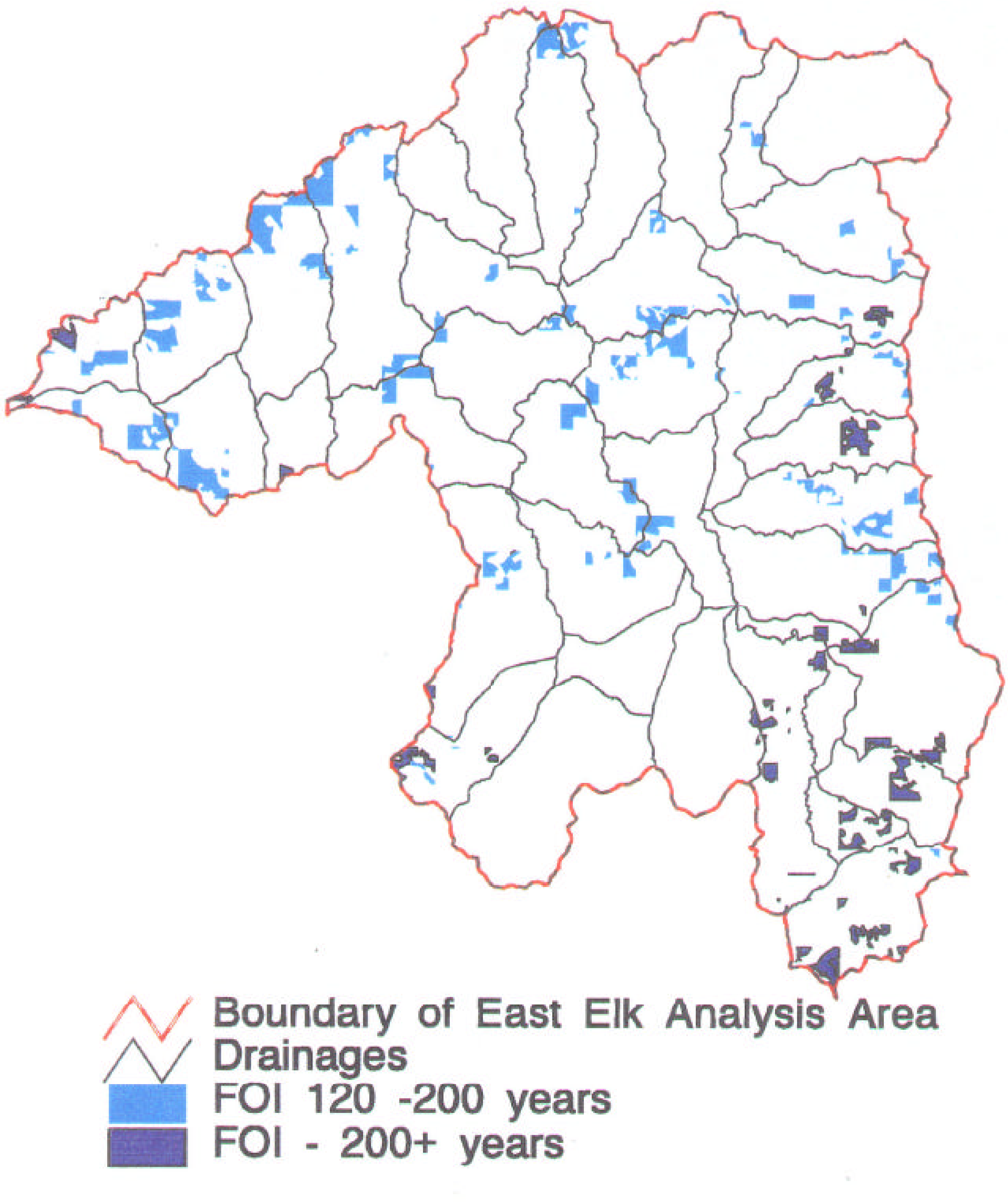
Inventory:
N - No surveys done
1 - Literature search only
2 - One field search done
3 - Limited field surveys done
4 - Protocol completed

Designated Critical Habitat Units



Spotted Owl Dispersal Habitat




Boundary of East Elk Analysis Area
Drainages
FOI 120 -200 years
FOI - 200+ years

HYDROLOGY

A. Introduction

The East Elk WAU is composed of 41 drainages in seven subwatersheds (Figure **1-4, pg l-7).** The stream system is represented by **Figure 5-1. Numerous** drainages in the WAU are frontal to Elk Creek or some other creek; therefore, they drain a much larger area than the delineated size of the drainage. Elk Creek is the **main** tributary, it is a seventh order stream.

Changes to the nahwal streamflow regime can be broken down into two major categories; increases in peak flows and decreases in summer low-flows. Specific areas of concern include high summer water temperatures, high pH, high turbidities during winter months, extremely low flows during summer months, and flow regimes which have been artificially altered. Higher peak flows can result in greater streambank erosion, greater sediment and debris transport, increased flooding, and degradation of fish habitat. Removal of forest canopy, ground compaction caused by tractor harvest and road construction, interception of ground water at road cut-slopes, and extension of channel network as a result of road ditchlines and relief culverts, have all been shown to increase peak flows.

Geology shapes the drainage patterns, determines the type of sediment available to the streams, and influences water chemisby Soils are a product of weathered bedrock. The type of soils present influence water infiltration rates, erosion potential, and vegetation. Vegetation affects channel stability and up slope erosion rates. Vegetation can also affect stream morphology by providing root strength to stabilize stream banks and by providing organic debris to the streams. Organic debris includes leaf litter, which is an important component of the food chain, and LWD (large woody debris), which form pools and capture gravel. Soil compaction occurs when tractors operate on tine textured soils. Livestock grazing and intense fire can also reduce the soil infiltration capacity.

The Roseburg District BLM has a Memorandum of Understanding with the City of Drain for the Bear Creek Municipal Watershed. This WAU includes the entire Bear Lake and Bear Creek Drainages, comprising 2,878 and 1,423 acres. The objective of this agreement is to maintain the best water quality for the City of Drain Water System via Best Management Practices to control non-point sources of pollution. The system provides domestic water for approximately 1,200 users near Drain. The source of water is Bear, Allen, and Lost Cabin Creeks.

B. Large Woody Debris (LWD)

LWD is extremely important in low gradient systems that contain an abundant source of tine sediment. Log jams, and to a lesser extent, individual pieces of large wood, act as a source of roughness that traps sediment and helps to moderate its progression down a given stream channel. In streams with extremely high sediment loads, the few areas of quality spawning gravel are often only found in association with these wood formations. Much of the wood naturally found in these systems has been on site for many years. The combination of a wide valley bottom, low gradient and meandering channel result in a system that tends to retain its LWD, rather than wash it downstream. It is assumed that previous stream clean-out efforts removed the LWD from almost all stream channels in the East Elk WAU. This is based on limited field inspection and a general review of ODFW inventories.

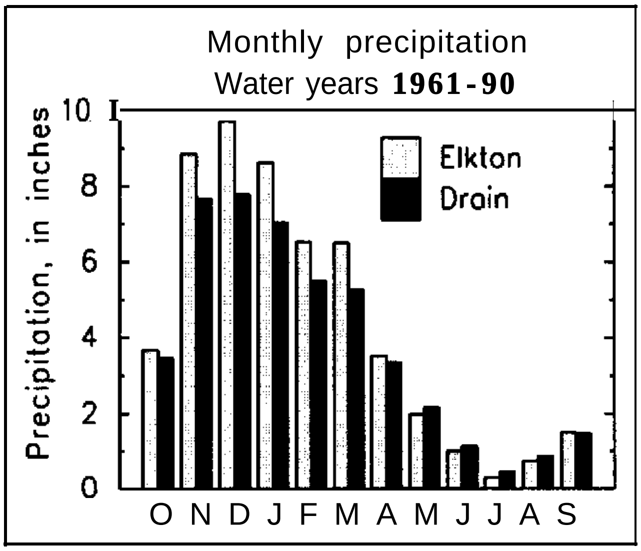
Beschta et al. (1995) states that large wood recruitment can greatly be diminished by short duration riparian harvest along large portions of a stream. As species composition changes to a deciduous dominated system, the recruitment of woody debris occurs after approximately 50 years. However, recruitment consist of pieces that are smaller and are subject to more rapid decay. Therefore, the effects on long term channel features is of less significance. Recruitment from coniferous second growth does not occur until approximately 100 years after harvest. **The** report also identified the chronic input of riparian trees as **possibly** the most important source of LWD. The episodic occurrence of upslope mass wasting and debris torrents deliver LWD to the system, as well.

Portions of Elk Creek and Pass Creek were identified by DEQ (1988) as having insufficient stream structure (problems with stream bank condition, amount and location of boulders and LWD, pool-riffle ratio, etc...). The rating may be in part due to a lack of LWD component in the stream. Existing data on LWD has not been Fully utilized for this watershed analysis. ODFW inventories contain some data on LWD and data on percent of ripsrian areas retaining OG trees. It is suggested that these data be analyzed in the future.

C. **Climate**

The East Elk WAU has a Mediterranean type of climate, characterized by cool, wet winters and hot, dry summers. Weather stations used to characterize precipitation and temperature are Drain near the middle of the WAU at an elevation of 292 fi and Elkton to the west at an elevation of 120 ft. They are NOAA weather stations and were selected because they are in or close to the study area and they have long term data available. Differences in precipitation and temperature should be expected throughout the WAU due to topographic variation, for example, precipitation is known to be dependent on elevation due to orographic effects. The climate data presented are 196 I-90 mean data from Owenby and Ezell, 1992. Annual precipitation ranges from 46 inches at Drain to 53 inches at Elkton, about 85% occurs from October to April; summer precipitation averages about 6 inches (Chart 5-1). Annual precipitation in the East Elk WAU probably ranges from about 40 inches at the outlet of Putnam Valley to 60 inches at the upper most elevations. Precipitation occurs mostly as rainfall since little of the study area is above 2,000 ft.

Chart 5-1. Comparison of monthly precipitation at Elkton and Drain, Oregon for water years 1961 to 1990.



Normal summer temperature data for Elkton and Drain are shown in **Table 5-1.** Summer maximum temperatures are typically in the low SO'sOF and winter minimum temperatures are in the mid 3O's"F.

Table **5-l.** Comparison of average temperature CF) at Elkton and Drain, Oregon for 1961 to 1990.

Month	Elkton			Drain		
	Maximum	Minimum	Mean	Maximum	Minimum	Mean
June	17.3	49.1	63.3	75.9	48.0	62.0
July	83.5	51.3	67.4	82.8	49.9	66.4
August	84.3	51.9	68.1	83.1	50.2	66.1
September	79.4	48.6	64.0	17.9	46.1	62.0

Three other NOAA climate stations are located approximately five miles from the watershed. The stations are Elkton **S**W to the west, Cottage Grove 1

WAU.

St3tiO"	Precipietioa	~cmpcrature, "F		
		ML%"	Maximum	Minimum
Elkto" 3 SW	52.9	55	66	43
CDttagc Grove l s	45.6	52	64	'VI
cottage Grove Dam	48. l	51	62	41

D. **Streamflow**

Rosgen (1994) suggests the importance of assessing the magnitude of the mean annual flood (recurrence interval=l.5 to 2.0 yr) because most of the work of stream erosion (over time) is done by flows of moderate magnitude with recurrence intervals of one to two years. This is significant where excessive amounts of fine sediment are in transport through the stream system. Elevated peak flows in some of the smaller drainage may also hinder natural adjustment and recovery processes within the streams by preventing aggradation and sorting of bedload and by hindering revegetation and stabilization of streambanks, as evident in the East Elk WAU.

Watersheds appear to be static units of the landscape; however, from a balance approach the watersheds are dynamic and changeable areas. After a runoff-producing event, the amount of water on the watershed naturally diminishes. Upper slopes dry out earlier than those areas close to stream channels until eventually only stream channels will contribute to streamflow. Conversely, when a runoff-producing event occurs, the area contributing to runoff gradually grows in the reverse manner. This is referred to as the variable source area.. Intiltration, antecedent moisture conditions, time of concentration, and variable source area are critical determinants to runoff volume. Timing, nature, and **distribution** of the precipitation, soil, vegetation, watershed characteristics, antecedent moisture conditions, **and** land use contribute to the amount of runoff. The movement of water through the watershed is greatly influenced by the vegetation cover. Early stage stands are subject to earlier, faster runoff as precipitation occurs resulting in direct surface runoff. Older stage stands are likely to have reduced overland flows. This is attributable to a higher water storage capacity within these stands. Water absorbency is enhanced with greater vegetation cover. Yoncalla subwatershed has more urbanization than do Elkhead or Upper Elk; therefore, it has a high proportion of its land impervious to water from pavement, roofs, and compacted lawns, etc., which will cause rapid runoff. The peak flow will most likely be higher on this WAU than on the more undisturbed watersheds, and the time of runoff will most likely be shorter even though the total amount of runoff may be greater.

Beschta et al. (1995) found that rain dominated regime may result in peak flows that occur when large amounts of precipitation fall directly on forest soils in late fall and early winter storms. After a timber harvest, transpiration is reduced and soil moisture levels are greater during fall months as compared to non-harvested areas. Increases in peak flows from harvested areas may be expected because of these soil moisture differences. As fall precipitation continues, moisture levels for the harvested and non-harvest areas are comparable. Furthermore, they say that studies were conducted in the Pacific Northwest which indicate that peak flows in the fall can increase more than 50% following a timber harvest. However, the fall peak flows are generally smaller than larger peak flows produced during larger winter storms. If the peaks were not separated on a seasonal basis, then no change in annual peak flows was apparent.

The report stated that cumulative potential peak flows from forest practices seems to be associated with road construction and timber harvests. However, small watershed studies are not entirely clear as to the magnitude and response or as to cause-and effect relationships. The report stated that reevaluation of small watersheds indicate that increases in peak flows were more related to temporal distribution of storms than absolute increases caused by forest practices. Inconsistent results of peak flow increases from small watersheds makes estimating cumulative effects of timber harvest sketchy.

The report also stated that cumulative effects from forest practices were likely to occur after a significant portion of the basin had been compacted. The Alsea Watershed study showed that after I2 percent of the basin had been compacted, peak flows increased about 28%. However, the 12 percent compaction level has not been demonstrated for other areas of the Pacific Northwest, although other shldies have shown increases in peak flows with increases in compaction.

Streamflow has been monitored in three locations in the East Elk WAU (Figure 5-Z), and are being used to characterize the streamflow in this watershed analysis. Streamflow for these sites are representative of the flow conditions found within the WAU. These sites were selected because they are located within the study area, have a long period of record, and no other data are known to exist.

Elk Creek near Drain (Station Number 14322000)

Continuous streamflow data were collected on Elk Creek near Drain for water years 1956 to 1973. There was no regulation of flow above the gage; however, there was small diversions by pumping for irrigation and the municipal supply for the town of Yoncalla is diverted upstream, from Wilson Creek. The gage was at an elevation of 306 ft. 1.7 mi southeast of Drain, 0.2 mi downstream from Yoncalla Creek, with an upstream drainage area of 104 m?. The base discharge (annual maximum) is 3,100 fi'/s. The average land slope of the WAU above the gage is 28 ft/mi and has a length of 19.5 mi. The average basin elevation is 1,015 ft.

Elk Creek near Elkhead. Orenon (Station Number 14321400)

Continuous streamflow data and crest-stage data were collected on this site. Before September 1, 1968 there was a non-recording gage at a site 20 feet upstream of the current location at a datum of 462.29 ft. The gage period of record is January to August, 1968 (gage heights and discharge measurements only); and September, 1968 to September, 1970; and October, 1986 to current year. There was no regulation on this drainage from 1968-197 1. There were diversions for irrigation above the station from 1968 to 1971, No record of regulation or diversions were noted for the station after 1971. The drainage area for the gaging station is 28.7 m?. Base discharge is 820 fi"/s. The datum of the gage was 463.99 ft above mean sea level.

Pass Creek near Drain. Oreeon (Station Number 14322400)

Crest-stage data have been collected at this site from 1956 to 1967. The drainage area for the gaging station is 61.90

mi^2. The average land slope of the WAU is 23 ft/mi and has a length of 13.2 mi. The average basin elevation is 800 ft. The datum of the gage is 302.06 feet above mean sea level.

The extremes of the daily discharge as published by the USGS by year are shown in **Table 5-3**. Instantaneous peak flow is determined from the maximum or minimum gage height of the day. Daily flow is determined from the average gage height for the entire day.

Table 5-3. Annual streamflow in ft^3/s for select gaging stations.

ELK CREEK NEAR DRAIN				ELK CREEK NEAR ELKHEAD				PASS CREEK	
WATER YEAR	INST PEAK FLOW [A]	ANN. MAX [B] DAILY Q	ANN. MIN [C] DAILY Q	WATER YEAR	INST PEAK FLOW [A]	ANN. MAX [B] DAILY Q	ANN MIN [C] DAILY Q	WATER YEAR	INST PEAK FLOW [A]
								1956	5,410
1956	9100	--	1.8	1969	1200	653	1.2	1957	2590
1957	4710	--	1.3	1970	2020	1280	.93	1958	5860
1958	7960	--	.7	1971	1400	1020	1.3	1959	3850
1959	7080	--	.5	--	--	--	--	1960	1900
1960	3930	--	.9	1987	1820	833	.61	1961	10300
1961	15000	11200	0	1988	2320	1400	.57	1962	3980
1962	11100	8400	0	1989	2270	1170	1.2	1963	2900
1963	4110	3510	0	1990	1170	444	.96	1964	6260
1964	12300	6470	.3	1991	558	398	.85	1965	8450
1965	10300	7610	0	1992	552	361	.54	1966	4030
1966	9660	6110	0	1993	493	418	.91	1967	1330
1967	3260	2150	.02	1994	259	209	.22		
1968	2150	1800	.03						
1969	4830	3360	.03						
1970	7530	4930	.02						
1971	5490	4120	.65						
1972	7660	5550	.03						
1973	1460	1250	.02						

A - instantaneous peak
B - maximum daily discharges for the water year (highest daily mean)
C - minimum daily discharges for the water year (lowest daily mean)

According to Moffatt et. al (1990) the average discharge for 18 years on Elk Creek near Drain was 222 ft^3/s (165,900 acre-ft/yr). Maximum discharge was 15,000 ft^3/s on February 10, 1961 with a gage height of 23.7 ft and no flow occurred at times. Statistical summaries compiled by Moffatt et. al (1990) for the period of record (1956-1973) are shown in **Table 5-4**. These data are based on mean daily discharge; therefore, the mean annual flow using this method is 218 ft^3/s. Statistical summaries for Elk Creek near Elkhead from 1968-1994 were compiled by Hubbard et. al (1994) (**Table 5-4**). Maximum discharge was 2,320 ft^3/s on January 10, 1988 and had a gage height of 6.77 ft; however, the maximum gage height for the period of record came from a crest-stage gage and measured 7.74 ft on December 21, 1969. Minimum discharge was 0.15 ft^3/s on August 28, 1994.

Table 5-4. Monthly and annual statistics of discharge in ft^3/s.
Elk Creek near Drain for 1956 to 1973

Month	Minimum	Year	Maximum	Year	Mean
Oct	5.5	1959	99	1957	20
Nov	8.6	1960	611	1962	207
Dec	32	1960	1,870	1956	559
Jan	66	1963	1,210	1964	597
Feb	126	1973	1,370	1961	504
Mar	83	1965	807	1961	400
Apr	62	1966	649	1963	189
May	18	1966	361	1963	105
Jun	6.7	1966	63	1958	28
Jul	0.9	1973	17	1963	7.0
Aug	0.1	1966	11	1968	2.4
Sep	0.9	1965	11	1978	3.9
Annual	106	1973	404	1956	218

Table 5-4 (cont.). Monthly and annual statistics of discharge in ft^3/s
Elk Creek near Elkhead for 1968 to 1994

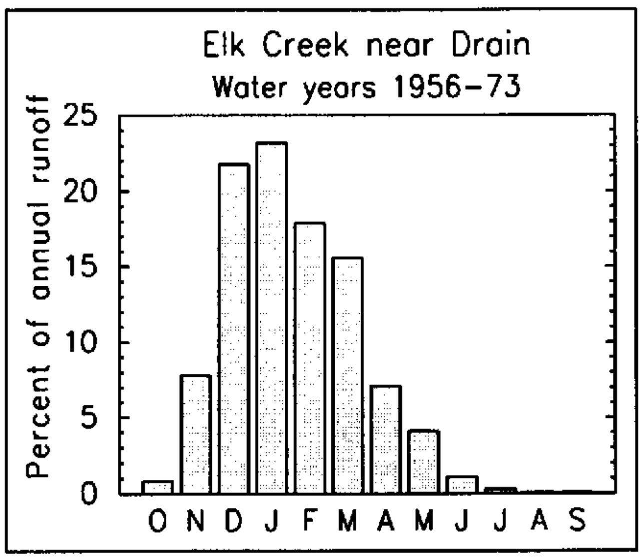
Month	Minimum	Year	Maximum	Year	Mean
Oct	1.5	1988	16.3	1969	5.6
Nov	3.7	1994	113	1969	52.4
Dec	15.6	1990	194	1969	106
Jan	35.4	1992	253	1970	139
Feb	31.1	1988	191	1969	89.5
Mar	19.2	1992	184	1972	85.9
Apr	21.0	1987	133	1993	56.4
May	8.2	1987	67.9	1991	28.2
Jun	3.3	1992	71.7	1993	15.3
Jul	1.6	1994	7.7	1993	4.0
Aug	0.5	1994	5.2	1993	1.8
Sep	0.4	1994	4.0	1971	1.9
Annual					45.9

The average percent of annual runoff for Elk Creek near Drain from Moffatt et. al (1990) is shown in **Chart 5-2**, it ranges from 23.2% for January to 0.1% for August and September, and 97.5% occurs from November through May. Streamflow in the East Elk WAU is assumed to be represented by the Elk Creek gaging stations. We should expect most of the streamflow to occur from November through May with the maximum in January. We should expect to find no flow on parts of Elk Creek for short periods of time, probably up to a week in August in normal years or a few days in July or September in dry years. However; this does not mean the entire WAU will dry up, only some stream reaches where all the surface water goes underground then resurfaces further downstream. Fourth order streams and greater in the head waters of the basin such as Elk Creek near Elkhead will most likely continue to flow year round being fed by soil moisture and fractured flow from upland sources. These streams don't have extensive alluvium and depth to bedrock is shallow or the stream channel is bedrock.

Summer low flows may be affected by human water withdrawals. An inventory of water rights for the Elk Creek watershed in 1993 lists 254 appropriated permits totaling 38.42 ft^3/s. The restriction on these water rights are not known. Domestic water withdrawal, irrigation, agriculture, and livestock watering have all contributed to the lower volumes of water being present in the stream channels during the summer months. The volumes withdrawn and the consequences are not known, but water removal during summer can potentially decrease available habitat for aquatic life and increase summer water temperatures and pH simply because less water is in the channel.

Changes to the summer low-flow can occur for a variety of reasons. The removal of large wood from a channel can cause the release of accumulated sand, gravel, and cobble from the upstream sides of these wood jams, as the stream cuts its way down. In a natural, healthy channel, these gravel storage areas act as large sponges, holding cool ground water and releasing it slowly. In the impacted channels, the gravel deposits are gone, intragravel flow is greatly diminished and overall water temperatures can increase. Roads can intercept surface and subsurface water, causing much of this water to run off of the landscape instead of recharging ground-water reserves. The harvest of riparian coniferous trees has allowed the development of hardwoods in many of the stream channels. Hardwoods use more water than conifers with a net result of less water in the stream (Hicks et al., 1991).

Chart 5-2. Percent of monthly runoff at Elk Creek near Drain for water years 1956 to 1993.



The flood frequency for Elk Creek near Drain determined by Friday and Miller (1984) is presented in **Table 5-5**. They did not estimate recurrence intervals of 50 and 100 years because the period of record was not long enough. Harris et. al (1979) presented discharges for selected flood-frequencies at gaging station using a different method that compares well to Friday and Miller (1984). These data are also presented in **Table 5-5** and include the discharges for flood frequencies at the Pass gaging station. Discharges for flood frequencies at the Elk Creek Near Elkhead gaging station were not available in the previously mentioned publications.

Table 5-5. Magnitude and probability of instantaneous peak flow for Elk Creek near Drain and Pass Creek near Drain.

ELK CREEK NEAR DRAIN, OR # 14322000: 1956-1973 Friday and Miller (1984)							
RECURRENCE INTERVAL, in years	1.25	2	5	10	25	50	100
ANNUAL EXCEEDENCE PROBABILITY	80%	50%	20%	10%	4%	2%	1%
DISCHARGE, in ft^3/s	3,580	6,110	10,500	14,000	19,100	--	--

ELK CREEK NEAR DRAIN, OR # 14322000, Harris et. al (1979)						
RECURRENCE INTERVAL, in years	2	5	10	25	50	100
ANNUAL EXCEEDENCE PROBABILITY	50%	20%	10%	4%	2%	1%
DISCHARGE, in ft^3/s	5,600	10,600	14,900	21,500	27,300	33,800

PASS CREEK near Drain # 14322400:						
RECURRENCE INTERVAL	2	5	10	25	50	100
ANNUAL EXCEEDENCE PROBABILITY	50%	20%	10%	4%	2%	1%
DISCHARGE (ft^3/s)	4,040	6,720	8,780	11,700	14,100	16,700

Significant recurrence intervals for major flows for Elk Creek near Drain and Pass Creek were extrapolated from the above tables. The Elk Creek near Elkhead recurrence intervals were calculated from a log pearson type III distribution computer model and rounded. The top five flows for each station are shown in **Table 5-6**.

Table 5-6- RECURRENCE INTERVALS FOR GAGING STATIONS

ELK CR NEAR DRAIN			ELK CREEK NEAR ELKHEAD			PASS CREEK		
FLOW (ft^3/s)	DATE	RETURN PERIOD (year)	FLOW (ft^3/s)	DATE	RETURN PERIOD (year)	FLOW (ft^3/s)	DATE	RETURN PERIOD (year)
15,000	2/10/61	25	1,820	2/2/87	4	5,410	12/26/55	4
11,100	11/23/61	6	2,320	1/20/88	8	5,860	2/15/58	5
12,300	1/19/64	9	2,270	1/10/89	7	10,300	2/10/61	43
10,300	12/22/64	5	2,020	12/21/69	5	6,260	1/20/64	5
9,660	1/4/66	4	1,400	1/17/71	3	8,450	12/24/64	13

The USGS method as suggested by Harris et. al (1979) can be used to estimate the magnitude and frequency of floods for the drainages of the East Elk WAU, results are presented in Table 5-7. The method requires area of lakes and ponds, drainage area, and precipitation intensity. The area of lakes and ponds was estimated to be less than 0.5% of the total area of the WAU; therefore, it was assumed to have little significant effect on the estimated flows and was not used in these calculations. It is suggested that future analysis include the effect lakes and ponds have on estimating the magnitude and frequency of floods. Precipitation intensity (I) is defined as the maximum 24-hour rainfall having a recurrence interval of 2 years. These values were determined from a map prepared by U.S. National Oceanic and Atmospheric Administration (1973). Estimates for *I* ranged from 3 inches at the lower elevations to 4 inches at the higher elevations.

Table 5-7. Magnitude and probability of instantaneous peak flow. Area is the drainage area of the drainage. Discharge in ft!/s for indicated recurrence interval, in years and annual exceedance probability, in percent. Range of peak flow in f?/s per mi'.

Drainage	Area, mi^2	I, inches	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
30 Elk	68.4[1]	3.0	3,241	5,246	6,457	8,369	10,012	11,351
McClintock	74.0[1]	3.0	3,468	5,622	6,920	8,976	10,747	12,184
Wehmeyer	5.6	3.0	377	580	714	902	1,052	1,194
Adams	6.3	3.5	498	768	944	1,191	1,387	1,567
E Milltown/ Elkhead/ Milltown/ N Milltown'	29.1'	3.5	1,855	2,953	3,629	4,649	5,497	6,213
Elkhead Mines	3.5	4.0	350	534	655	820	946	1,067
Shingle Mill	5.9	4.0	548	845	1,038	1,305	1,514	1,707
Walker	8.6	4.0	758	1,178	1,445	1,824	2,125	2,396
Ellenburg Cr	3.1	3.0	226	345	424	533	618	701
Fitch Cr	57.1'	3.0	2,775	4,475	5,508	7,127	8,510	9,648
Little Sand	14.0'	3.0	828	1,299	1,598	2,039	2,402	2,723
Lower Pass	62.4'	3.0	2,995	4,839	5,956	7,713	9,218	10,450
Middle Pass	52.5'	3.0	2,581	4,156	5,116	6,614	7,890	8,946
Rock Cr	5.9	3.0	394	607	747	945	1,103	1,250
Sand Cr	8.7'	3.0	550	855	1,052	1,336	1,565	1,774
Drain	186.0'	3.5	9,147	15,106	18,565	,24,229	29,185	32,986
Hardscrabble	8.6	3.5	650	1,010	1,241	1,571	1,835	2,074
India"/ Lancaster C?	203.7'	3.5	9,891	16,364	20,111	26,271	31,673	35,798

'Area not the same as previously mentioned.

aFro"tal of the sane stream; therefore, they have been combined into one drainage

Table 5-7. Magnitude and probability of instantaneous peak flow. Area is the drainage area of the drainage. Discharge in ft'/s for indicated recurrence interval, in years and annual exceedance probability, in percent. Range of peak flow in fk'is per m?.

Drainage	Area, m?	I, inches	2 50%	5 20%	IO 10%	25 4%	50 2%	100 1%
Jack Cr	6.3	3.5	498	768	944	1,191	1,387	1,567
Middle Elk	188.4'	3.5	9,248	15,278	18,775	24,507	29,523	33,369
Parker Cr	5.0	3.5	408	627	770	970	1,126	1,273
Sunnydale	198.0'	3.5	9,652	15,960	19,615	25,615	30,874	34,896
cox Cr	5.4	3.5	436	671	824	1,038	1,207	1,364
Curtis Cr	36	3.5	2,228	3,561	4,376	5,618	6,657	7,524
Lee's Cr	3.3	4.0	333	507	622	778	898	1,012
Scot& Valley	6.0'	4.0	556	858	1,053	1,324	1,537	1,733
Thiel Cr	11.3'	4.0	959	1,498	1,838	2,326	2,718	3,063
Bear Cr	5.4	4.0	508	782	960	1,206	1,398	1,576
Buck Cr	5.2	4.0	492	756	928	1,166	1,351	1,523
Pheasant Cr	27.2[1]	3.5	1,751	2,782	3,419	4,378	5,173	5,846
Upper Pass	7.4	4.0	666	1,032	1,266	1,596	1,856	2,093
Ward Cr	15.5[1]	3.5	1,079	1,696	2,084	2,654	3,118	3,524
Cowan Creek	3.00[1]	4.0	307	466	572	715	824	929
Devore Mtn/ Halo Cr[2]	29.6[1]	4.0	2,195	3,494	4,289	5,481	6,465	7,287
Huntington Cr.	4.3[1]	4.0	418	640	785	984	1,139	1,284
Rice Hill	8.9	4.0	781	1,214	1,490	1,881	2,192	2,471
Range of Peak Flow	--	--	47-102	76-155	94-191	121-238	145-275	165-310

These data can be useful for future management purposes and in the design of river crossings (culverts and bridges) for the area. A single channel draining a specific area is necessary in order to apply this method. The area of many of the drainages was increased to include the flow from upstream drainages. Peak flows were divided by area and the range of data are shown in units of f?/s per m? (csm). These data are inversely proportional to area and directly proportional to I, for example, smaller watersheds produce higher peak flows per m? also watersheds with higher I produce higher peak flows.

The USFS (1990) developed a hydrologic recovery procedure to evaluate the cumulative effects of timber harvest on streamflow. In this report they say that hydrologic recovery should be used to index the influence that timber stand structure has upon snow accumulation and the rate at which it melts, especially during large, channel-forming floods which result from warm air and rain falling on snowpacks. However, the preferred drainage size should be within 1,000 to 5,000 acres. The East Elk WAU is characterized as predominately a rain dominated precipitation regime. Peak flows occurring in the East Elk WAU should not be effected by the transient snow zone (elevations between 2,000 and

5,000 ft). The East Elk WAU is mostly below 2,000 ft in elevation, the area above 2,000 is shown in **Table 5-8**, it totals less than 2%. These data were compiled from GIS. The subwatershed with the most area in the transient snow zone is Elkhead with 2,112 acres.

Table 5-8 - Area in the transient snow zone (drainages not listed are below 2,000 ft).

DRAINAGE	TSZ (ACRES)	%TSZ
ADAMS	452.0	11.3
ELKHEAD	21.4	1.9
ELKHEAD MINES	347.7	15.6
MILLTOWN	151.3	3.3
SHINGLE MILL	660.9	17.5
WALKER	478.4	8.7
ELKHEAD SUBWATERSHED TOTAL	2111.6	9.3
COX CR	32.4	0.9
CURTIS CR	104.3	4.5
LEE'S CR	94.1	4.4
SCOTTS VALLEY	0.1	0.0
UPPER ELK SUBWATERSHED TOTAL	231.0	1.6
BEAR CR	1.3	0.0
UPPER PASS	5.3	0.1
UPPER PASS SUBWATERSHED TOTAL	6.7	0.0
TOTAL FOR EAST ELK WAU	2349.2	2.2

E. Geomorphology

Watersheds are sculptured by water, wind, and ice and evolve over time through erosion processes. Geomorphology is one of the sciences that aids in understanding this phenomenon and is fundamental to the study of watershed hydrology (Black, 1991). A number of geomorphic parameters can be obtained from maps or through GIS. These characterize watersheds by quantitatively describing them and can provide information used in making management decisions. The stream's characteristics are influenced by eight factors which change over time. They are: channel width, channel depth, water velocity, the amount of water, slope of the stream channel, roughness of the stream channel, amount of sediment, and the size of sediment (Leopold et al., 1964). In addition, stream bank vegetation influences bank stability. A change in one factor causes all other factors to adjust accordingly. For instance, if the amount of sediment entering the stream increases, the stream channel may fill with sediment, causing the channel to widen and the bank erosion to occur.

Area is an important geomorphic feature that can be used to estimate total annual yield and flood potential. Only 17 of the 41 drainages function as individual watersheds where all the streamflow found in that drainage originates solely within that drainage basin and has only one outlet. The other drainages are frontal or contain some area that is a frontal. New drainages should be delineated that would be more useful in describing the hydrology of the contributing upstream area since we are interested in watershed effects and not some convenient line drawn on a map. Drainages that are frontal should be combined to include both sides of the stream and drainages that now contain some frontal area should simply have the frontal area deleted from that drainage. What we are now analyzing and calling drainages arc land units not drainage basins.

Area does not affect average annual flow unless the watershed is influenced by groundwater storage and evapotranspiration. The East Elk WAU is about 204 mi*,. **The** minimum flow of a larger watershed may be more sustained than that of a small watershed because of large ground-water storage. If the gradient of the larger watershed is low such as Elk Creek near Drain the flow of that watershed may go entirely underground and the stream would dry up. If the same amount of rainfall is uniformly applied over two watersheds of different size, peak flows will be greater on larger watersheds when measured in absolute flow units (ft'/s). However, when measured in units per unit area (csm) peak flows are lower and later on larger watersheds. Small watersheds exhibit higher high flows and lower low flows. Small watersheds are more likely to receive precipitation and deliver it as runoff simultaneously, where as precipitation on large watersheds takes longer to reach the outlet from remote portions, thus not all of the watershed is contributing simultaneously to peak flow. According to Black (1991) maximum peak flows, decay time, total runoff time, and time of concentration increases as the size of the watershed increases.

Drainage density is a calculation of the total length of all stream segments of all orders in miles divided by the effective drainage area in square miles (Horton, 1932). It may be thought of as a closeness of spacing of channels or the length of channels per unit area. Thus drainage density is one of several linear measures by which the scale of features of the topography can be compared. The lowest values are considered to be between 3.0 and 4.0 milmi' found in the Appalachian Plateau Province (Chow, 1964). Values in the range of 8 to 16 are typical of large areas of the humid central and eastern U.S. on rocks of moderate resistance under a deciduous forest cover. In dry area's of the Rocky Mountain region values range from 5O.to 100. Values have been measured as high as 1,100 to 1,300 in badlands developed on weak clay at Perth Amboy, New Jersey.

There are approximately 1029 miles of streams and the drainage density is 5.1 miimi' for the East Elk WAU (Table 5-9). Drainage density can be related to e&on potential. Sunnydale has the highest drainage density and Ward Creek has the lowest. According to Chow, (1964) the higher drainage density the more complex the watershed and the faster streamflow will respond to rainfall; therefore, soils can be expected to erode easily, slopes are steep, and vegetation sparse. It should be noted that not all lengths of natural streams that flow during winter rain storms may have been mapped; therefore, drainage density may be higher than that shown in Table 5-9.

Wemple (1994) developed a process and investigated the effective extension of stream networks resulting from~road drainage. She estimated that roads in her study area extended the stream network 60% over winter base flow stream lengths and 40% over storm event stream lengths. The road densities found in her study area were I.6 mi/mi'. Road density in the East Elk WAU are 2.5 to 9.9 mi/m? (Table 5-9, Figure 53); however, not all roads are on GIS and the actual road densities are probably higher. With an increase in surface flow as a result of ditch lines in a watershed, the rain or melting snow gets into streams quicker. Road drainage maybe a major cause of increased winter peak flows in streams in our area. The majority of roads within the East Elk WAU arc constructed with ditches and/or insloped road surfaces that are intended to control water flow from the road surface. Once it is in the ditch, much of the water reaches the local stream channels faster than in an unroaded situation. In fact, some ditchlines effectively function as stream channel, so the actual length of flowing "streams" during rain storms is extended in the form of road ditches. Stream and road lengths and densities for the drainages in the East Elk WAU are shown in Table 5-9 and Figure 5-3. The highest road density is found in Thiel Creek and the lowest is found in E Milltown. The highest drainage density is found in Sunnydale Creek and the lowest is found in Ward Creek. When the drainage density is increased by the construction of roads we can expect to see more runoff in the form of increased peak flows and greater increases in mean annual floods. Drainage basins with fewer streams per mi' will experience higher winter peak flows as B result of roads than basins that naturally have a lot of streams. There are fewer streams to handle the rapid runoff so streamflow increases are greater, potentially leading to down cutting, bank failures, bed scour, and mass wasting where streams undercut adjacent slopes. The dominant factor affecting peak flows in these smaller basins is basically just how quickly the water gets to the channels. The problem is compounded when the ground is harvested by tractors which usually compacts soils, further adding to surface runoff. In addition, erosion of driven road surfaces varies greatly with the type and amount of traffic, season of use, and the type and quality of road surface material (Reid and Dunne, 1984).

The number of stream crossings by roads that can be counted in GIS is shown in **Table 5-9**, no field inspection has been conducted for these data. The actual number are most likely higher since many roads and first and second order streams have not been entered in GIS. The crossing density can be used for comparison and as an indicator of potential for culverts to plug. The risk for potential peak flow increases by the potential channel extension was estimated by the number of stream crossings in the East Elk WAU. It was assumed that the highest crossing densities, and therefore greater hydrologic integration to the stream network, would have the greatest potential for peak flow increases from road related run-off. The crossing density can be used to show the drainages or subwatersheds proportional potential for culverts being plugged during a 100 year flood. See the Aquatic Habitat and Fish section for further discussion about existing ditchline lengths between culverts and sizing for 100 year flood events on federal lands.

Slope is important because it is a prime factor in infiltration capacity. Combined with elevation, slope can be an important factor in orographic effects, and combined with aspect, slope is also important in insolation considerations that play a role in evapotranspiration and snowmelt. At higher elevations slopes are generally higher with lower infiltration rates and more rapid runoff. Soil depth tends to be less at higher elevations owing to shorter time for soil to form. The overall effect is that average annual runoff is greater from small, high-elevation, steep-sloped, thin-soiled watersheds. Aspect is the direction of exposure to solar radiation of a particular portion of a slope, and orientation is the general direction of the main stem of the stream on the watershed. A watershed with an east-west orientation is likely to have slopes that are predominately north and south in aspect. Aspect is important to insolation, south-facing slopes are drier than north-facing slopes which are cooler. South-facing slopes are likely to have lower average annual runoff than other portions of the watershed. A general review of the orientation of the main channel(s) and major tributaries of the subwatersheds was done. The main channel was based on stream order. Other high stream orders were considered main tributaries. The information in **Table 5-10** was derived from a stream map generated by the BLM GIS/Arc Info system.

Table 5-10 - GENERAL STREAM CHANNEL ORIENTATION

GENERAL ORIENTATION OF THE STREAM CHANNELS		
SUBWATERSHED	MAIN CHANNEL	MAJOR TRIBUTARIES
DODGE CAMP	SW	SE, NW
ELKHEAD	N, NW	NE, NW
LOWER PASS	SW, SE	S, SE, SW
PUTNAM VALLEY	W	S, SW, N
UPPER ELK	SW	W, SW, NW
UPPER PASS	SW	NW, SE, SW
YONCALLA	N, NE	W, E, NE, SW

Streams may be divided into sediment source areas, transport areas, and depositional areas based on the slopes or gradient of the stream channels. Very little of the East Elk WAU was inspected. High gradient streams are source areas for debris torrents. Medium gradient streams are transport areas that do not change significantly with time. It is presumed that these streams are lacking in LWD. Sediment tends to pass through them rather than be deposited. In general, low gradient streams are the most likely to change due to deposition and erosion of sediments. These streams provide the best quality for fish habitat because they have meanders, under cut banks, deep pools, large amounts of downed logs, and gravel tend to accumulare in these reaches. This is not occurring in the East Elk WAU. Instead we find many stream channels have been **eroded** down to bedrock, probably due to increase peak flow from timber harvests and road densities, channel downcutting due to over grazing on streambanks, and the lack of LWD because of previous stream clean out practices.

The stream order and lengths of stream in GIS for the East Elk WAU are presented in Table 5-11. A stream order analysis was conducted by the Roxburg BLM on the Brush Creek, Hayhurst, and Yoncalla subwatersheds. Error was found in the amount of first and second order streams represented by the GIS database. If was found that the number of first order streams was less than the second order streams. It is not possible to have more second order streams than first order streams. By definition, second order streams have first order tributaries while first order streams have no tributaries (Black, 1991). It is likely that not all first order stream are in GIS due to short of stream length, or the **channel could not be defined.**

F. **Water Quality**

1. Standards by Law and Beneficial Uses

The Clean Water Act of 1977 (Bureau of National Affairs, 1977, Set 101 a.) states: the objective of fhis Act is to restore and maintain the chemical, physical, and biological integrity of the nations' waters. The act directs the State to set water quality standards that are not to be exceeded. Water quality will be managed fo protect and recognize beneficial uses.

The Oregon Administrative Rules Antidegradation Policy (OAR 340-41-026) intent is to maintain water quality of the state (DEQ, 1994). The general policy for surface waters is to guide decisions that affect water quality such that unnecessary degradation from point and nonpoint sources of pollution is prevented, and to protect, maintain, and enhance existing surface water quality to protect all existing beneficial uses. The Standards for this policy for the Umpqua Basin is set forth in Oregon Administrative Rules (OAR 340-41.282). OAR 340-41-282 sets forth specific water quality standard which are not to be exceeded, designed to protect designated beneficial uses.

OAR 340-41-282; Table 3, identifies Beneficial Uses for the Umpqua Basin. *For All Other Triburaries to Umpqua, North & South Umpqun Rivers the* following are considered beneficial uses:

*Public Domestic Water Supply
*Industrial Water Supply
'Livestock Watering
*Salmonid Fish Rearing
*Resident Fish & Aquatic Life
*Fishing
*Water Contact Recreation
*Hydra Power
"Private Domestic Water Supply
*Irrigation
'Anadromous Fish Passage
*Salmonid Fish Spawning
*Wildlife & Hunting
*Boating
*Aesthetic Quality

2. Current and Historic Cooditioos

The DEQ routinely monitors 3,500 mi of streams. **Table 5-12 summarizes the** DEQ (1988) assessment of nonpoint source pollution related to stream water quality conditions for certain beneficial uses and probable causes. Dates and frequencies for these data are not available; therefore, the time of the year and the magnitude of the problem is not known. These data are the only historic data available except for temperature. Theft Creek and Yoncalla Creek are not shown in Table S-12. Both creeks rated as "No problem and/or no data available" in the DEQ report.

Table 5-12- SUMMARY OF DEQ 1988 NPS ASSESSMENT

TRIBUTARY (& DEQ D)	POLLUTION TYPE AND SEVERITY		,fm*crm BENEFICIAL USE(S)	PROBABLE CAUSE
XK CREEK (23)	TURBIDITY	MODERATE PRO!aEM,	IRRIGATION	TRAFFIC’
	LOW DO	MOD PROBLEM, DATA	COLDWATER FISH	“EGETATION REMOVAL
	NUTRIENTS	MOD PROBLEM. OBSERVATION	OTHER AQUATIC LLFE	
	SED,MENTAT,ON	MOD PROBLEM, OBSERVATION		
	STREAMBANK EROSION	MOD PROBLEM, OBSER”AT,ON		
	DECREASED FLOW	MOD PROBLEM, DATA		
	,NS”FFIC,ENT STREAM STR”CTURE	MOD PROBLEM,		
3_K CREEK (312)	TURBIDITY	MOD PROBLEM, OBSER”ATIOi-4	IRRIGATION	TRAFFIC
	LOW DO	MOD PROBLEM, DATA	COLDWATER FISH	“EGET,tATION REMOVAL
	BACTEKIA/“IRUSES	SE” PROBLEM, OBSERVATION	OTHER AQUATIC L,FE	
	SEDIMENTATION	MOD PROBLEM, OBSERVATION		
	STREAMBANK EROSION	MOD PROBLEM, OBSER”AT,ON		
	DECREASED FLOW STREAMFLOW	MOD PROBLEM, DATA		
XK CREEK (373)	T”RB,D,TY	MOD PROBLEM, 0BSER”ATION	IRR,CAT,ON	TRAFFK
	LOW DO	MOD PROBLEM. DATA	COLDWATER FISH	“EGETATION REMOVAL
	TOXKS	MOD PROBLEM, DATA	OTHER AQUATIC LIFE	
	BACTERIANIRUSES	SE” PKOBL.EM, DATA		
	SEDIMENTATION	MOD PROBLEM, OBSER”AT,ON		
	STRFAMBANK EROSION	MOD PROBLEM, OBSERVATION		
	DECREASED FLOW STREAMFLOW	MOD PROBLEM, DATA		
‘ASS CREEK (26)	TURB,D,TY	MOD PROBLEM, OBSERVATION	COLD WATER F,SH	TRAFFIC
	LOW DO	MOD PROBLEM, OBSERVATION	OTHER AQUATIC LIFE	“EGETATION REMOVAL
	N”TR,ENTS	MOD PROBLEM, OBSERVATION		
	STREAMBANK EROSION	MOD PROBLEM, OBSER”AT,ON		
	DECREASED FLOW STREAMFLOW	MOD PROBLEM, OBSER”AT,ON		
	,NS”FF,C,ENT STREAM STRUCTURE	MOD PROBLEM, OBSERVATION		
<OCR CREEK (27)	LOW DO	SE,” PROBLEM, OBSERVATION	COLDWATER FISH	RIPARIAN “EGETATION & BANK DISTURB: GENERAL
	DECREASED FLOW	SE” PROBLEM, OBSERVATION	OTHER AQ”AT,C L,FE	
iAND CREEK (28)			COLDWATER FISH OTHER AQUATIC L,FE	RIPARIAN “EGETATION & BANK DIsr”RB. GENERAL

. “cm,s,ia*“k dislurbanrc b” h”mM or mimd ,mrsc

3. Sream Temperature

The DEQ has set forth in Oregon Administrative rules, Chapter 340-41-282 water quality standards for the Umpqua River Basin. Water temperature is one characteristic that is to be managed to protect recognized beneficial uses. The standards identify that no measurable increases in water temperature when stream temperatures are 58 degrees or greater and/or no more than a two degree increase when stream temperatures are 56 degrees or less. The State of Oregon's water quality standard for temperature is being revised upward, currently in streams with salmonids water temperatures must be maintained at or below 58 °F. In non-salmonid streams, no increase above 64 °F is allowed. The BLM does not monitor stream temperature in the WAU.

The cooperative study by the Bureau of Reclamation and Douglas County Water Resource Survey (1991) stated that Elk Creek Waters may not meet water temperature standards on a seasonal basis. **Table 5-13** was extracted from the fore-mentioned Status Report and EA.

Table 5-13 - EXCEEDENCE FREQUENCY^ (%) OF CRITICAL WATER TEMPERATURES

TEMP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
ELK CREEK NEAR STREAM RIVER MILE 42.2 (7/79-9/89).												
58	0.7	0.0	0.0	0.0	0.0	0.0	0.3	13.6	60.2	95.2	99.0	36.7
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	3.8	16.5	9.7	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
ELK CREEK NEAR DRAIN (11/86-9/89)												
58	40.3	0.0	0.0	0.0	0.0	0.0	5.6	39.8	75.6	100	98.9	68.9
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6	38.9	65.9	59.3	7.8
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	6.7	18.2	6.6	0.0
ELK CREEK NEAR ELKTON												
---- NO LONG TERM DATA AVAILABLE----												

A - EXCEEDENCE FREQUENCY PERCENTAGE BASED ON MEAN DAILY TEMPERATURE.

The report cited that spot measurements on Elk Creek near Elkton showed periodic temperatures which exceeded 80°F. Temperature problems may be attributed to low flows and poor riparian canopy in certain reaches. The data in the report shows the time of critical temperature as follows:

*Near Elkhead - June through early September
*Near Drain - late May through early October
*Near Elkton - May through October.

The span of time of critical temperatures appears to increase with the downstream direction, which may be a reflection of the tendency of downstream temperature increases. In general, we see peak temperatures in July when streamflow decreases and the maximum temperature to decrease with distance from the Umpqua River.

The width and height of riparian vegetation on either side needed to provide effective shade varies depending on the width of the stream, the direction of flow (orientation to the sun), and the steepness of the streambanks. Many studies have investigated the effects of riparian vegetation on stream temperatures in the forest of the Pacific Northwest. Holaday (1992) found a trend of decreasing temperature with recovering riparian vegetation which had been removed by flooding, debris flows, or timber harvest. Stream channel characteristics can effect stream temperatures. Streams with narrow channels tend to have cooler stream temperatures. A stream with a gentle gradient is typically wide with shallow flow and slow velocity all of which contribute to stream heating. The diurnal fluctuation in temperature from day to night is important to aquatic organisms and overall water quality. Stress in fish and other organisms is reduced during night time recovery of cooler water. The loss of riparian shade increases the diurnal (day to night) water temperature fluctuation. In a managed basin such as Steamboat Creek, a tributary of the North Umpqua River, diurnal fluctuation has averaged from 7 to 1 I OF, while in the unmanaged Boulder Creek wilderness, it has averaged 4 "F (Holaday, 1992). The land management activities that have occurred in the East Elk WAU, more specifically, the timber harvests and removal of riparian vegetation by over grazing have probably been the major contributors to the high stream temperatures currently found within the streams.

Stream temperatures can be effected by groundwater flows. Groundwater input has the tendency to cool streamflow either from fractured flow of bedrock or from deep soils that produce sustained summer flows. Shallow soils have low moisture storage and contribute less to summer flows. Snow melt sustains summer flows and cool stream temperatures,

4. Dissolved Oxygen

The equilibrium concentration of dissolved oxygen (DO) in water in contact with air is a function of temperature and pressure. The higher forms of aquatic life require oxygen for survival. According to Hem (I 985) the DO concentration may be depleted by processes that consume dissolved, suspended, or precipitated organic matter, and values above equilibrium can be produced in systems containing actively photosynthesizing biota. Low DO **(Table 5-12) has been** identified by DEQ as a moderate problem.

5. **Sedimentation and Turbidity**

Streams carry **suspended particles or sediment.** Particle size depends on the amount of flow. According to Hem (1985) a generalized terminology call sediment having particle diameters ranging from 0.24 to 4 urn "clay", 4 to 62 urn "silt", and 62 urn to 2.0 mm "sand" In general, suspended sediment may be considered a pollutant when it exceeds namral concentrations by increasing the turbidity to a point that it affects the biotic balance. Sediment data have not been collected by the BLM in this WAU; however, there does exist historical sediment data collected by the USGS for Elk Creek. It is suggested that these data be analyzed in future analysis.

The mass movement of soils by landslides (debris avalanches, debris flows, and earthflow and slumps) is a major component of hillslope erosion and sediment transport to streams in mountain areas. Landslide distribution, frequency, and magnitude are controlled by the following: I) slope steepness, 2) amount of subsurface water, 3) degree and depth of bedrock weathering, 4) presence of concave landforms that serve to concentrate ground water and accumulate sediment deposits, and 5) relationship of these landforms with downslope stream channels (Swanson, 1991). Landslides are generally initiated by unusual weather events such as intense winter storms, rapid snowmelt, or prolonged periods of rain. They increase dramatically following intense wildfire, timber harvest, road building, or during earthquakes. In general, steeper slopes have a higher potential for ground failure and sediment input to streams tends to be higher in rain dominated rather than snow dominated areas (Swanson, 1991).

Surface erosion and landslides are natural cyclic processes that strongly influence hydrologic patterns and water quality. Roads also have the potential to affect the sediment regime but not linked to a natural process. Added erosional effects can occur when culverts plug or fail to handle peak flows, causing streams to divert out of their original **channel, flow down the road** grade, and enter the channel of another stream. As stated earlier, erosion of driven road surfaces varies greatly with the type and amount of traff~, season of use, and the type and quality of road surface material (Reid and Dunne, 1984). No quantification of these types of road-related surface erosion were made for these analyses and they are suggested for future data needs. Overall, the quantity of sediment associated with mass wasting and potential stream crossing failures needs to be evaluated.

Turbidity reduces the depth to which sunlight penetrates and thus alters the rate of photosynthesis and can impair the capture of food by fish. Turbidity is an expression of the optical property of water that scatters light (Dunne and Leopold, 1978). The scattering increases with suspended particulate matter, which may be organic or inorganic.

Turbidity increases with, but not as fast as, suspend-sediment concentrations. The DEQ has set forth in Oregon Administrative rules, Chapter 340-41-282 water quality standards for the Umpqua River Basin. Turbidity is another characteristic that is managed to protect recognized beneficial uses. The standards set forth that no more than a ten percent increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity.

McDonald et al. (1990) indicated that high turbidity levels can impact salmonids feeding and growth of salmonids and other fish species. Levels of the range of 25-70 nephelometric turbidity units (NTU, measured by photoelectric turbidimeter) impairs the ability of salmonids to find and capture food. Also, growth is reduced and gill tissue is damaged after 5-10 days of exposure to turbidities of 25 NTU. They also found that turbidity can impact drinking water, recreational and aesthetic uses of water.

The cooperative study by the Bureau of Reclamation and Douglas County Water Resource Survey (1991) described Elk Creek as suffering from high turbidity and color levels. A comparison to EPA's drinking water limits of 1 Nephelometric Turbidity Unit and 15 color units was done for three locations on ElK Creek. **Table 5-14** was extracted from the fore-mentioned Status Report and EA.

Table 5-14 - TURBIDITY AND COLOR DATA

LOCATION/SAMPLE INFO	COLOR[A]	TURBIDITY[B]
ELK CR @ BRIDGE, NEAR RM 42.2		
# OF SAMPLES	14	16
MEAN	51	12
MAX	175	45
ELK CREEK NEAR DRAIN		
# OF SAMPLES	-	35
MEAN	-	11
MAX	-	50
ELK CREEK NEAR ELKTON (DEQ)		
# OF SAMPLES	63	35
MEAN	24	19
MAX	100	120

A - EPA DRINKING WATER STANDARD - 15 COLOR UNITS
B - EPA DRINKING WATER STANDARD - 1 NEPHEOLOMETRIC TURBIDITY UNITS

6. pH

The pH of a natural water is a useful index of the status of equilibrium reactions in which the water participates. In a aqueous solution it is controlled by interrelated chemical reactions that produce or consume hydrogen ions (Hem, 1985). The pH of a solution is a measure of the effective hydrogen-ion concentration (activity) and could be expressed in mg/l but H^+ concentrations are very low for water solutions that are not strongly acid. The activity of hydrogen ions can be expressed most conveniently in logarithmic units, and the abbreviation pH is shorthand for $p(H^+)$ where the symbol p means the negative base-10 log and (H^+) stands for the hydrogen-ion activity. Thus, pH = $\log(H^+)$ in moles per liter. The pH scale goes from 0-14. Solutions having a pH less than 7 are described as acid, whereas solutions with a pH of greater than 7 are described as basic or alkaline. At pH 7, only 1×10^{-7} moles per liter of the hydrogen ion is present, and the hydrogen-ion content does not begin to approach the status of a major component of the solution until the pH is less than 4.0. Dissolved gases such as carbon dioxide, hydrogen sulfide, and ammonia appreciably effect pH

The DEQ has set forth in Oregon Administrative rules, Chapter 340-41-282 water quality standards for the Umpqua River Basin. pH is a characteristic that is managed to protect recognized beneficial uses. The pH standard for aquatic life in the Umpqua Basin is 6.5 to 8.5, set by DEQ. Levels above or below have adverse effects on some life cycle stages of **certain** fish and aquatic macroinvertebrares. MacDonald et al. (1990) found that pH levels of greater than 9 and less than 6.5 can have an adverse affect on fish and aquatic insects. However, sub-lethal affects of higher pH levels on fish are **not known.**

The Little River Watershed Analysis (BLM and USFS, 1995, pointed out that accumulation of algae in streams could affect pH. The process of photosynthesis consumes H+ ions during the daylight hours, elevating pH (more alkaline) and at night pH decreases. Diurnal algae-driven pH cycles in Little River were found to be as extreme as 9.1 in the late afternoon to 7.8 in the morning. Shaded stream reaches and on cloudy days not as much photosynthesis occurs and pH levels are lower. In river waters not influenced by pollution, the process of photosynthesis by aquatic organisms take up dissolve CO, during daylight and release CO, at night by respiration, fluctuation of pH may occur with the maximum pH values reaching as high as 9.0 (Hem, 1985). No known historical data are available for the WAU.

The Little River Watershed Analysis identified conditions that could promote algae growth and accumulations where 1) lack of riparian shade can increase productivity of algae, 2) the presence of bedrock creates habitat for algae, but poor habitat for algae eating insects, and 3) nutrient availability (increase). The analysis also identified conditions that could promote lower pH included I) riparian shade 2) gravel/cobble substrate and large wood in streams, which provide habitat for algae eating insects, 3) forest stands upslope which cycle and store nitrogen in vegetation **and** soil so that it is not available to for runoff. Nutrient runoff into streams from harvested areas plays a primary role in increased algae and pH levels. In Coyote Creek a 70 % increase was found in algae growth in waters from a clear cut stream compared to partial and no cut basins. MacDonald et. al (1991) also reported increased nutrient loading in streams following timber harvest and road building.

7. Trace Metals

The DEQ has set forth in Oregon Administrative rules, Chapter 340-41-282 water quality standards for the Umpqua River Basin. Trace metals are characteristics that are managed to protect recognized beneficial uses. The criteria designates that trace metals shall not be introduced above nahlral background levels in waters of the state in amounts, concentrations or combinations which may be harmful, may chemically change to harmful forms in the environment, 01 may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare; aquatic life, wildlife; or other designated beneficial uses. The criteria for trace metals shall not exceed the criteria from EPA (1986) for the various metals. This criteria is consistent with the criteria used to evaluate the information in Table 5-15.

Table 5-15 STANDARD VIOLATIONS FOR TRACE METALS - EXCEEDENCE FREQUENCY (%)

METAL	# OF SAMPLES	DRINKING WATER	IRRIGATION	AQUATIC LIFE
CADMIUM	13	0	0	15.3%
CHROMIUM	9	0	0	A
COPPER	13	0	0	31.0%
LEAD	13	0	0	7.6%
MERCURY	13	B	0	B
ZINC	13	0	0	23%

A - TO DETERMINE IF HEXAVALENT FORM OF CHROMIUM POSES A THREAT TO AQUATIC LIFE ADDITIONAL SAMPLING AND ANALYSIS IS NEEDED.

B - INCONCLUSIVE STATISTICAL ANALYSIS. MAY NEED ANALYSIS OF ADDITIONAL SAMPLES.

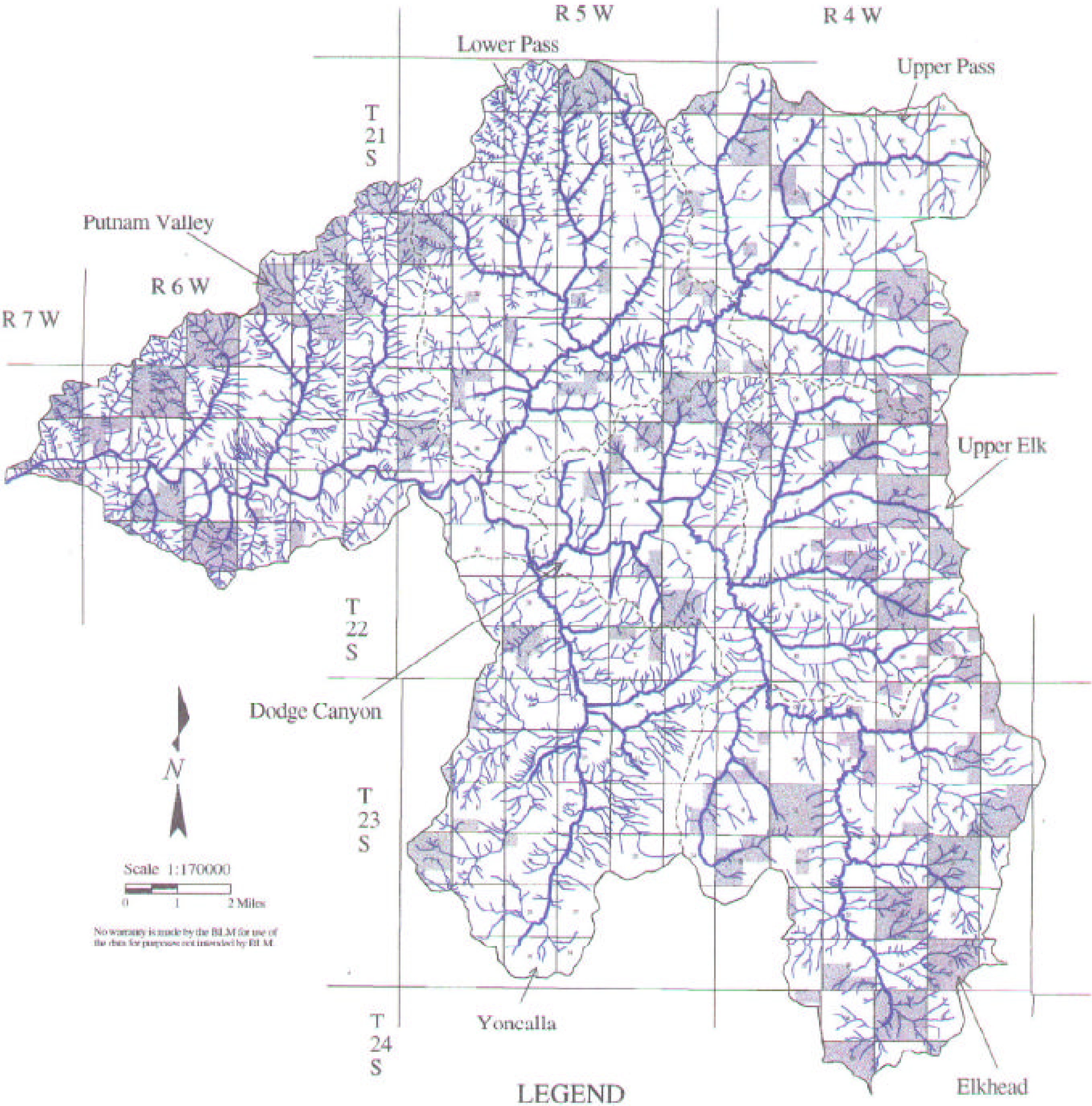
A cooperative study by the Bureau of Reclamation and Douglas County Water Resource Survey (1991) described Elk Creek as having potential water quality problems associated with trace metals. They collected water quality samples at the Elk Creek bridge RM 42.2 (Figure S-2). Concentrations of cadmium, chromium, copper, lead, mercury, and zinc, at times exceeded standards set to protect aquatic life. Table 5-15 presents the results from this study and shows the standard violations for these trace metals. The drinking water and aquatic life standards are from the National Interim Primary Drinking Water Regulations as presented by the EPA (1986) and the irrigation standards are from the National Academy of Science, USA. They suggested further sampling to more accurately quantify the frequency and magnitude of these exceedences. In addition, they found no problem with mercury in fish tissue; however, they suggest further sampling of tissues should be conducted.

The report further suggest that Elk Creek could have high ambient levels of trace metals because it lies within the "quicksilver belt" of Oregon. Within the Elk Creek Basin, Elkhead Mine Mercury Mine operated from approximately 1870 to 1971. Soil samples from the abandoned mine shows that some trace metals have been spread by wind and water. Water samples taken from the mine area had elevated mercury levels and could be a public health problem if consumed. As stated above, trace metal samples taken from Elk Creek don't exceed drinking water standards, but in some cases they do exceed aquatic life standards. Tbhis shows that caution should be used when considering these waters as municipal and industrial water sources, since treatment may be required.

8. Ground Water

Robison and Collins (1977) describe the ground water in the Drain-Yoncalla area as diverse in chemical character. There is no definite pattern in chemical character. There is no definite pattern of distribution of the types of water but waters with a high concentration of dissolved solids are more likely to be found near the contacts of the basalt members and the sandstone and siltstone member of the Umpqua Formation. The Tyee Formation is not characterized by a single type of water, except that high concentrations of dissolved solids are not common. The average water temperature reported by drillers was 54 "F almost the same as the mean annual air temperature at Drain (53 9).

East Elk Streams



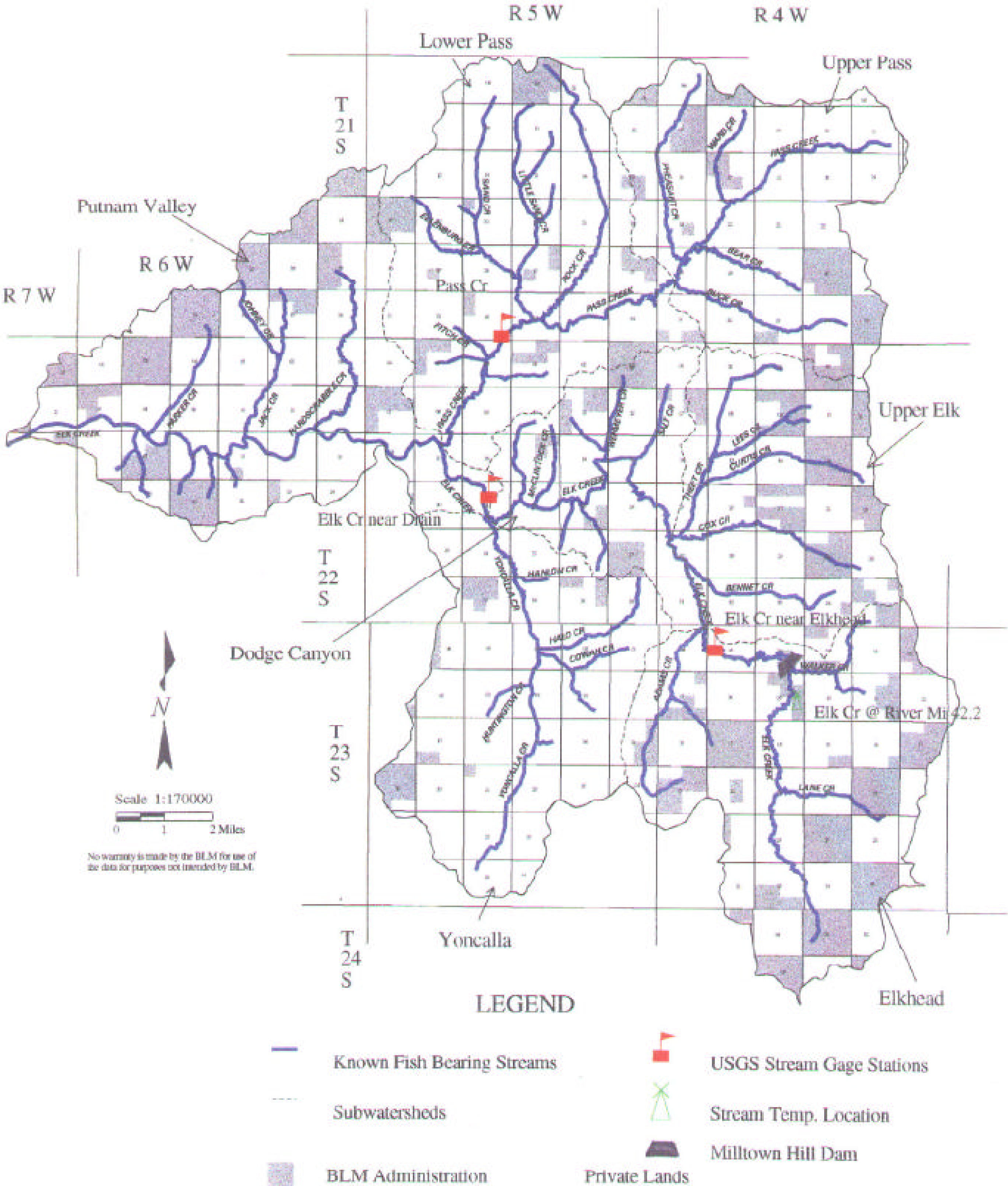
LEGEND

Streams

Known Fish Bearing Streams

Subwatersheds

East Elk Stream Gage Locations

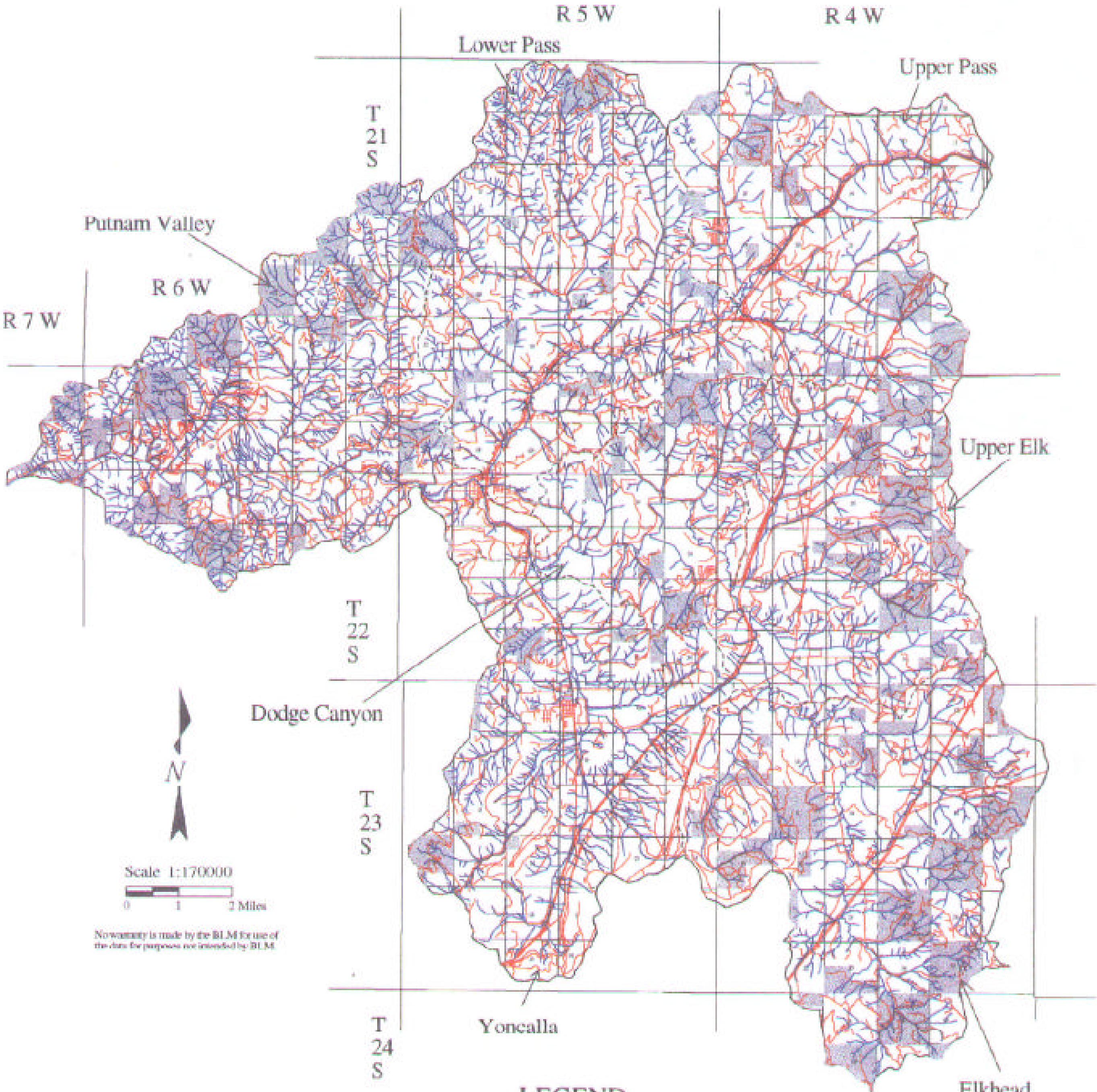


EAST ELK WATERSHED
Drainage. Road Densities & Stream Crossines

DRAINAGES SUBWATERSHEDS	Stream Miles	Drainage Density (mi/mi^2)	Road Miles	Road Density (mi/mi^2)	No. of Road & Stream Crossings
30 Elk	20.6	4.2	34.8	7.1	52
McClintock	22.3	4.4	17.8	3.5	23
Wehmeyer	30.8	5.5	31.9	5.7	36
Dodge Canyon	**73.7**	**4.7**	**84.5**	**5.4**	**111**
Adams	20.1	3.2	43.7	7.0	36
E Milltown	4.6	3.2	3.6	2.5	2
Elkhead	9.5	5.4	8.8	5.0	11
Elkhead Mines	17.3	5.0	19.0	5.5	22
Milltonw	27.8	3.9	29.2	4.1	40
N Milltown	5.3	5.8	5.2	5.6	12
Shingle Mill	28.4	4.8	28.0	4.8	65
Walker	32.5	3.8	50.0	5.8	49
Elkhead	**145.4**	**4.1**	**187.4**	**5.3**	**237**
Ellenburg Cr	19.6	6.4	12.5	4.1	18
Fitch Cr	22.0	4.8	22.3	4.9	33
Little Sand	30.4	5.8	26.0	4.9	37
Lower Pass	20.5	3.8	34.5	6.5	42
Middle Pass	26.9	5.0	34.1	6.3	52
Rock Cr	29.1	4.9	29.8	5.0	40
Sand Cr	41.0	7.3	26.8	4.8	48
Lower Pass	**189.5**	**5.4**	**186.1**	**5.3**	**270**
Drain	23.2	4.5	45.6	8.9	46
Hardscrabble	60.6	7.1	40.7	4.8	71
Indian Cr	22.1	7.0	17.5	5.6	35
Jack Cr	46.3	7.3	28.7	4.5	58
Lancaster Cr	19.6	7.8	7.1	2.8	8
Middle Elk	14.7	6.0	16.0	6.6	11
Parker Cr	40.7	8.1	39.6	7.9	47
Sunnydale	38.1	8.3	29.1	6.4	58
Putnam Valley	**265.2**	**7.0**	**224.4**	**5.9**	**334**
Cox Cr	26.7	5.0	28.3	5.3	38
Curtis Cr	12.7	3.6	23.5	6.6	21
Lee's Cr	12.1	3.6	20.9	6.3	22
Scotts Valley	31.9	5.1	26.4	4.2	42
Thiel Cr	20.9	4.7	43.9	9.9	53
Upper Elk	**104.4**	**4.5**	**142.9**	**6.2**	**176**
Bear Cr	18.0	3.3	30.2	5.6	32
Buck Cr	22.9	4.4	37.0	7.2	54
Pheasant Cr	22.7	3.5	33.3	5.1	21
Upper Pass	24.3	3.3	43.2	5.9	89
Ward Cr	6.7	2.5	20.9	7.8	19
Upper Pass	**94.7**	**3.5**	**164.7**	**6.1**	**215**
Cowan Cr	19.5	5.8	29.8	8.9	80
Devore Mtn.	39.6	5.3	49.7	6.7	59
Halo Cr	31.0	5.8	21.1	3.9	31
Huntington Cr	26.1	5.8	25.5	5.7	39
Rice Hill	40.4	4.5	67.0	7.5	123
Yoncalla	**156.6**	**5.3**	**193.1**	**6.5**	**332**
EAST ELK TOTAL	**1029**	**5.1**	**1183**	**5.8**	**1675**

Figure 5-3

East Elk Roads & Streams



LEGEND

Roads

Streams

BLM Administration

Private Lands

Table 5-11

ELK CREEK STREAM LENGTHS & DENSITIES

DRAINAGES			STREAM ORDER LENGTHS								TOTAL MI. BY	STREAM DENSITY
Subwatersheds	ACRES	SQUARE MI.	1	2	3	4	5	6	7	Unknown	DRAINAGE	MI./SQ.MI.
30 ELK	3131.9	4.9	1.6	6.8	2.1	0.7	0.0	5.7	0.0	3.6	20.5	4.2
MCCLINTOCK	3251.7	5.1	0.0	9.6	4.5	2.2	0.0	2.8	0.0	3.1	22.3	4.4
WEHMEYER	3588.9	5.6	1.7	10.0	5.4	2.4	1.7	0.9	0.0	8.6	30.8	5.5
Dodge Canyon	**9972.5**	**15.6**	**3.4**	**26.5**	**12.0**	**5.3**	**1.7**	**9.4**	**0.0**	**15.3**	**73.6**	**4.7**
ADAMS	4002.2	6.3	1.2	6.5	3.4	3.3	0.0	0.0	0.0	5.8	20.1	3.2
E MILLTOWN	912.1	1.4	0.4	1.8	0.2	0.1	1.1	0.0	0.0	1.0	4.5	3.2
ELKHEAD	1127.5	1.8	0.7	3.3	1.4	0.0	0.8	0.0	0.0	3.3	9.5	5.4
ELKHEAD MINES	2223.0	3.5	2.2	6.1	1.7	2.0	0.0	0.0	0.0	5.3	17.3	5.0
MILLTOWN	4536.1	7.1	3.2	11.8	1.1	0.1	4.5	1.0	0.0	6.0	27.8	3.9
N MILLTOWN	588.1	0.9	0.4	0.5	0.0	0.0	0.0	2.6	0.0	1.8	5.3	5.8
SHINGLE MILL	3775.6	5.9	6.7	9.2	5.2	2.1	1.2	0.0	0.0	4.1	28.4	4.8
WALKER	5490.3	8.6	3.4	10.6	7.5	2.8	1.6	0.0	0.0	6.6	32.5	3.8
Elkhead	**22654.9**	**35.4**	**18.2**	**49.7**	**20.5**	**10.3**	**9.1**	**3.6**	**0.0**	**33.9**	**145.4**	**4.1**
ELLENBURG CR	1960.9	3.1	4.1	5.3	3.0	0.9	1.5	0.0	0.0	4.8	19.6	6.4
FITCH CR	2918.8	4.6	2.7	8.3	3.1	1.8	0.0	1.5	0.0	4.7	22.0	4.8
LITTLE SAND	3379.1	5.3	2.9	7.9	3.7	2.2	0.0	1.3	0.0	12.4	30.4	5.8
LOWER PASS	3419.9	5.3	0.0	8.0	4.8	2.2	0.0	2.7	0.0	2.8	20.5	3.8
MIDDLE PASS	3454.4	5.4	1.1	8.1	2.1	0.0	4.4	0.0	0.0	11.2	26.9	5.0
ROCK CR	3806.5	5.9	2.8	6.8	1.4	5.4	0.0	0.0	0.0	12.8	29.1	4.9
SAND CR	3586.1	5.6	3.4	11.7	3.7	1.8	3.1	1.1	0.0	16.2	41.0	7.3
Lower Pass	**22525.7**	**35.2**	**16.9**	**56.2**	**21.7**	**14.3**	**9.1**	**6.5**	**0.0**	**64.8**	**189.5**	**5.4**
DRAIN	3286.6	5.1	0.9	4.2	2.2	1.4	0.0	0.0	5.8	8.6	23.2	4.5
HARDSCRABBLE	5486.8	8.6	6.9	19.0	6.5	2.2	5.2	0.0	0.0	20.8	60.6	7.1
INDIAN CR	2016.1	3.2	7.1	6.8	2.9	0.0	0.0	0.0	1.4	3.9	22.1	7.0
JACK CR	4063.2	6.3	7.3	14.8	4.8	1.9	4.3	0.0	0.0	13.2	46.2	7.3
LANCASTER CR	1617.5	2.5	4.1	4.2	2.1	1.0	0.0	0.0	1.7	6.6	19.6	7.8
MIDDLE ELK	1554.2	2.4	1.7	3.1	1.7	0.6	0.0	0.0	2.2	5.4	14.7	6.0
PARKER CR	3213.1	5.0	10.6	12.4	3.0	2.7	1.7	0.0	0.4	9.9	40.7	8.1
SUNNYDALE	2925.9	4.6	5.0	10.5	4.0	1.6	0.0	0.0	3.2	13.9	38.1	8.3
Putnam Valley	**24163.5**	**37.8**	**43.6**	**74.9**	**27.2**	**11.3**	**11.3**	**0.0**	**14.6**	**82.2**	**265.2**	**7.0**
COX CR	3437.0	5.4	4.3	7.4	3.3	4.5	0.0	0.0	0.0	7.3	26.7	5.0
CURTIS CR	2298.4	3.6	0.9	3.6	3.5	0.9	0.0	0.0	0.0	3.8	12.7	3.5
LEE'S CR	2133.2	3.3	1.1	3.3	2.1	1.9	0.0	0.0	0.0	3.7	12.1	3.6
SCOTTS VALLEY	3999.4	6.2	1.2	9.7	3.2	3.8	0.2	0.9	0.0	12.9	31.9	5.1
THIEL CR	2844.7	4.4	0.8	5.4	3.4	0.7	3.7	0.0	0.0	6.8	20.9	4.7
Upper Elk	**14712.8**	**23.0**	**8.3**	**29.4**	**15.5**	**11.8**	**3.9**	**0.9**	**0.0**	**34.5**	**104.4**	**4.5**
BEAR CR	3452.8	5.4	0.0	5.6	3.4	4.0	0.0	0.0	0.0	5.0	18.0	3.3
BUCK CR	3302.5	5.2	0.0	7.7	4.2	1.0	0.0	0.0	0.0	9.9	22.9	4.4
PHEASANT CR	4199.8	6.6	2.1	5.4	4.3	4.3	1.2	0.0	0.0	5.4	22.7	3.5
UPPER PASS	4732.5	7.4	0.0	10.9	2.9	1.2	3.1	0.0	0.0	6.2	24.3	3.3
WARD CR	1725.6	2.7	0.0	2.0	2.1	0.0	1.4	0.0	0.0	1.1	6.7	2.5
Upper Pass	**17413.2**	**27.2**	**2.1**	**31.6**	**17.0**	**10.6**	**5.7**	**0.0**	**0.0**	**27.7**	**94.7**	**3.5**
COWAN CR	2156.6	3.4	0.0	7.6	2.8	1.2	0.2	0.1	0.0	7.7	19.5	5.8
DEVORE MTN	4762.2	7.4	0.0	12.7	9.3	2.2	1.4	1.5	0.0	12.5	39.6	5.3
HALO CR	3425.0	5.4	0.0	9.7	6.0	2.3	0.0	2.9	0.0	10.2	31.0	5.8
HUNTINGTON CR	2858.7	4.5	0.0	8.6	3.5	3.6	0.5	0.0	0.0	9.9	26.1	5.8
RICE HILL	5725.7	8.9	0.0	20.3	5.9	1.2	3.3	0.0	0.0	9.6	40.3	4.5
Yoncalla	**18928.3**	**29.6**	**0.0**	**58.8**	**27.5**	**10.5**	**5.5**	**4.5**	**0.0**	**49.9**	**156.6**	**5.3**
EAST ELK	**130370.8**	**203.7**	**92.5**	**327.2**	**141.3**	**74.1**	**46.4**	**25.0**	**14.6**	**308.3**	**1029.3**	**5.1**

GEOLOGY AND SOILS

A. General Geology and Soils Characteristics

1. Geology

The East Elk WAU lies predominately within the Coast Range Geomorphic Province. *The Geology and Mineral Resources of Douglas County* (1972), characterizes the Coast Range Geomorphic Province as having lower relief and less deformation than the Klamath Mountains Province. However, the terrain may be rugged in places due to the resistance of many sandstone interbeds and small intrusive bodies to erode. Mineral resources in the province is limited to localized quarry rock, sand and gravel and unworked deposits of impure coal.

The Bureau of Land Management (BLM) ArcInfoiGIS system geology theme (Figure 6-1) was based on the United States Geologic Survey (USGS) 1:500,000 Geologic Map Of Oregon. The explanations were based on the *Explanation For Geologic Map of Oregon* (Walker and MacLeod, 1991). The USGS survey identities the rock units within the WAU. In general, the map units are composed primarily of marine sedimentary rocks, and to a lesser extent intrusive igneous rocks and volcanic rocks.

The dominant unit is the Tt, Tyee Formation. The Tyee Formation is rhythmically interbedded marine sandstones and siltstones with minor interbeds of dacite tuff in the upper part. In general, the Tyee Formation is found in the northinorthwest and central portion of the WAU.

Tib, Basalt and and&e intrusions. The unit consist of sills, plugs and dikes of basalt and andesite. They represent mostly feeders exposed by erosion.

Tss, Tuffaceous siltstone and sandstone which consist of thick to thin bedded marine tuffaceous mudstone, sandstone, and siltstone, tine to coar?.e grained.

Tsr, Siletz River Volcanics and related rocks consist of vesicular pillow flows, tiff-breccias, massive lava flows, and sills of basalt.

Tmsm, Marine sandstone, siltstone and mudstone. Consist of rhythmically interbedded marine sandstone, siltstone, and mudstone that were deposited in the deep-sea fan depositional setting on the Siletz River Volcanics submarine basalts.

Tfe, Fisher and Eugene Formations of the Oligocene and upper Eocene epochs are found along the earem edge of the WAU. The Fisher Formation, which interfingers and overlaps the Eugene formation in the upper parts is older and&tic lapilli tuff, breccia, waterlaid and airfall silicic ash, and basalt lava flows. Basalt lava flows within the Fisher Formation are as old as 40 Million years old. The Eugene formation is feldspar and mica bearing sandstone and siltstone.

The Qls, landslide and debris-flow deposits (Holocene and Pleistocene epochs, and some Pliocene), is an unstratified mix of fragments of adjacent bedrock.

Qal, alluvial deposits (Holocene) of sand, gravel, and silt forming floodplains and filling channels of present streams. In places, it includes talus and slope wash. The deposit locally includes soils which contain abundant organic material and thin peat beds.

Over most of the WAU the geologic formations were folded in a series of anticlines and synclines whose axis are oriented SW to NE. The dip of the strata is generally in the direction away from the axis of the anticlines and towards the axis of the synclines (Figure 6-2).

2. Topography

The dip of the sedimentary rock strata greatly influenced the topography which developed. This is particularly so with the Tyee Formation. Slopes with aspects in good alignment with the direction of the dip are generally less steep and less dissected than those slopes whose aspects are in poor alignment. In many cases these changes in topography crossing over ridgelines onto a different aspect are dramatic, going from relatively gentle to very steep and greatly incised. It is not uncommon for the relatively gentle slopes in alignment with the dip to be broken at intervals by narrow bands of very steep slump escarpments, some of which are rock cliffs.

In contrast to the sedimentary rock strata, the Si1et.z volcanic rocks do not seem to exhibit a discernable aspect relationship for topography. Its slopes are on average mid range in steepness and not as deeply incised as the Tyee slopes which are in poor alignment with the dip. Figure 6-3 illustrates these relationships of dip, and topography for the Tyee(Tt) and Siletz River(Tsr) formations.

Elevations range from 200 feet on Elk Creek near Elkton to 2612 feet on Ben More Mountain on the southwestern border of the Elkhead subwatershed. The topographic relief going from the bottoms of the larger perennial streams to the ridgetops varies from about 300 feet to 1800 feet at Ben More Mountain. Compared to most other watersheds in the district, East Elk has a relatively low percentage of area (17 percent) with slopes greater than 60 percent (Figure 6-4, Table 6-S). However, a large percentage of the steepest ground falls on BLM administered lands, particularly in the northern part of the WAU. The Tyee Formation accounts for about 90 percent of the steep slopes. The 0 to 3 percent slope class on Figure 6-4 closely outlines the major floodplains.

3. Soils

A large number of soil mapping units from the Natural Resource Conservation Service's soil survey of Douglas County is represented (143). This is largely the result of the diversity of the geology and of the wide range of soil moisture regimes, depths, textures, and slope classes. Other characteristics that add to this complexity are soil drainage and mineralogy and the presence of rock outcrop as a major component. The soil mapping unit maps for each subwatershed are in the appendix of this **report as** well as tables giving some of their important characteristics. Mapping units were lumped in different ways according to certain characteristics to form the maps shown in Figures 6-5, 6-6, 6-7, 6-8, and 6-9.

Based on these maps of soil characteristics the following general statements may be made of the main geologic formations in the WAU:

Tyee sedimentary rocks: Clayey soils of mixed mineralogy and soil depths of moderate to very deep are dominant on slopes 0 to 60 percent although loamy soils have good representation in the 30 to 60 percent range. On slopes greater than 60 percent loamy and loamy skeletal textures and shallow and moderately deep soil depths dominate (Skeletal refers to high rock fragment content in the soil). A fair amount of this area above 60 percent slope has rock outcrop as a major component. Only small areas on slopes less than 60 percent has rock outcrop as a major component.

Siletz River Volcanics: Little of this formation occurs on slopes greater than 60 percent. Clayey soils with depths of moderately deep to very deep dominate. Mixed clay mineralogy is the most abundant although montmorillonitic mineralogy(high in montmorillinite clay) is locally common. Little of the montmorillonitic mineralogy occurs outside of this fornation. Soils high in montmarillonite clay have high shrink-swell capacities. Certain endangered species occur on montmorillonitic soils with poor drainage (Figure 6-7).

Marine sedimentary **rocks** capping the Siletz River Volcanic Basalts: Clayey soils with moderate to very deep depths dominate although loamy soils with shallow soil depths have fair representation.

Spencer sedimentary rocks: The soil depths are mostly moderate to very deep. Clayey soils with mixed mineralogy dominate the slopes under 60 percent. Above 60 percent slope both clay and loamy soils with mixed mineralogy are well represented,

Fisher and Eugene Formation: Slopes less than 60 percent are most common although the steeper slopes are well represented. Clayey soils of mixed mineralogy with depths of moderate to very deep dominate.

Quaternary Alluvium: The extent and shape of the Quaternary alluvium is not very actively depicted on the geology map. The soils are very deep and have a wide range of textllres. Many of these soils are mapped as being poorly drained (aquic moisture regime) or somewhat poorly drained where seasonably high water tables are present **(Figure 6-8).** Small areas of bordering upland soils also were mapped with these soil drainages. Most of the poorly and somewhat poorly drained soils occur in the Yoncalla, Pleasant Creek, Putnam, Scot@, and Shoestring Valleys as well as along portions of Elk, Jack and Hardscrabble Creeks.

B. **Issues and Key Questions**

Soil productivity and water quality are issues of most importance from the soil perspective. Management of the land in the WAU (primarily urban development, grazing, faming, road construction and maintenance and timber harvesting) cumulatively has had over time a major impact through accelerated surface erosion and mass wasting as well as extensive compaction and alteration of the hydrology.

Key questmns:

What impacts are currently being created and what are their short term and long term implications?

What are the long term impacts to the soils of past management?

C. Past Conditions **and Management During the Last 50 Years**

Undisturbed Forest Soils tend to have surface layers which are relatively high in organic matter, have low bulk densities and are friable. The soil structure of the surface layer is typically granular. Many subsoils are low in organic matter and naturally dense (high bulk densities). The soils described above were probably the dominant condition in the forested land prior to European influence. These surface features would be negatively altered 01 destroyed by periodic hot fires or massive landslides.

Time constraints did not allow interpreting the old aerial photos. This was done in the previous watershed analyses of other subwatersheds in the Tyee Resource Area. The general trend in these other subwatersheds in commercial timber land seemed to progress in four phases.

Phase I: In the 1950's and 1960's extensive timber harvesting occurred with much road construction being concentrated in riparian zones. In some cases spurs or skid trails were bladed right in the drainage bottom of intermittent and the smaller perennial streams. Sidecasting of road cut material on steep slopes was a common practice often directly entering stream channels or failing as debris avalanches. A large percentage of the roads were unsurfaced and not as much attention was give" to drainage features as today. Large areas were downhill yarded (both cable and tractor) as well as yarded uphill.

The common end result was high levels of erosion, sedimentation and in high landslide hazard areas, mass wasting leaving many riparian areas and stream channels in a raw, sediment-chocked state. Large debris avalanche-debris torrent combinations would occw in some drainages, especially in association with intensive precipitation events. These large debris avalanche-debris torrent combinations associated with big precipitation events would occur both in disturbed settings and undisturbed forest. The most devastating ""es were the apparently rain-on-snow events of the December 1964 storm. The elevations of East Elk Creek WAU may be too low for the rain-on-snow to have been a factor.

Phase 2: From the late sixties to the early eighties roads moved more to ridgetop positions and uphill cable was dominant although tractor yarding was still common on the gentler slopes. Sidecasting on steep slopes was still practiced. Erosion, sedimentation and mass wasting was still at relatively high levels where concentrated harvesting was occurring.

Phase 3: For the remainder of the eighties the level of road construction declined as most of the main arterials were in place. The practice of sidecasting on steep slopes declined. The levels of erosion, sedimentation and mass wasting declined significantly probably because of the combination of better harvesting and road construction techniques, less area in new clearcuts and a series of drought years. Also, riparian zones which were hit hard in the past were in advanced states of revegetation. The debris torrents which earlier devastated riparian zones left behind beneficial amounts of large woody debris and gravel in the zones of accumulation.

Phase 4: The amount of ground harvested increased getting into the nineties as clearcuts were being concentrated on private second growth stands. A rise in landslide activity coincided with two years of above normal precipitation. Road construction was also on the rise. Road systems were being relocated to accommodate more uphill cable yarding and to avoid old, overly steep graded roads and riparian areas. Current cumulative levels of erosion, sedimentation and mass wasting appear to be considerably less than those of the fifties through seventies. However, roads probably still present a cumulatively significant contribution of sediment to the streams and are probably the largest source of sediment today.

Large scale harvesting of timber and clearing of the land for agriculture in the East Elk WAU probably was initiated much earlier than those WAUs which were briefly discussed above. Parallels of historic impacts can probably be drawn between East Elk and these other WAUs. The same conclusion about current condition seems to apply where commercial forest is dominant.

D. Present Conditions

1. Landslide Inventory

Due to time constraints an inventory was done of landslides primarily by interpreting the June 1994 aerial photos and by making some limited field observations. The effective span of time covered using the 1994 aerial photos is probably no more than about ten years. This is because landslide scars heal to the point where after ten years confident identification on the photos is low except for the largest slides. For the completed watershed analyses in the Tyee Resource Area six to eight aerial photo flights from 1959 to 6/89 or 6/94 were interpreted to give a much better picture of landslide history. They were augmented by many field observations. These past landslide inventories have largely been confined to the Tyee and related formations. The Siletz River Formation was observed during the Brush Creek-Hayhurst Valley-Yoncalla Watershed Analysis. Since Yoncalla is also part of the East Elk WAU more complete information is available for it. Knowledge gained from past inventories will be extrapolated to this analysis as appropriate.

The inventoried slides were categorized as small (less than 0.1 acre), medium(0.1 to 0.5 acre) and large (greater than 0.5 acre). To better visualize the classes, a borderline small-medium slide might be about 35 ft. wide and 125 ft. long while a borderline medium-large slide might be 70 ft. wide and 310 ft. long.

The slides were also classified as to their place of origin and cause. Those categorized under the label of "forest" originated in undisturbed natural stands or reestablished forests of at least ten years of age. In-unit related slides originated in young clearcuts or thinnings and were not apparently caused by roads. Road related slides were caused by the undermining of support by road cuts, by the sidecast loading of slopes, by the concentration of road drainage or a combination of the three. Judgment calls had to be made on slides which occurred a short distance below a road since road drainage may be a factor.

Forty-one slides were identified. Twenty-five of these slides occurred in the five year period between the 6/89 and the 6/94 aerial photos. The oldest was a large in-unit slide which occurred in the mid to late seventies. The identified landslides are categorized by geologic formation, size, and origin(forest, in-unit, road) in **Tables 6-1, 6-2, 6-3, and 64** below.

Table 6-l Landslides bv Geologic Formation

Geologic Formation	Number of slides	Percentage of slides
Tyee	**30**	**13.2**
Spencer	8	**19.5**
Fisher and Eugene	3	7.3
~other formations	0	0.0

Table 6-2 Landslides by Size

Landslide size	Number of slides	Percentaee of **slides**
small (CO. 1 acre)	19	46.3
medium (0. I to 0.5 acre)	17	41.5
large (>O acre)	5	12.2

Table 63 Landslides by Origin

Landslide oriein	Number of slides	**Percentaae** of slides
Forest	1	2.4
In-unit	31	75.6
Road	9	22.0

Table 6-4 Landslides by Total and Size

	Number of Slides			
	small	medium	large	TOTAL
forest	0	I	0	I
in-unit	17	II	3	31
road	2	5	2	9
TOTAL	19	17	5	41

2. Road Inventory

The road inventory in the field was largely limited to BLM roads listed as unsurfaced in the GIS data base. Problems with other roads were noted enroute to these unsurfaced roads. During this first iteration of watershed analysis unsurfaced roads were categorized according to the type of work recommended to reduce present adverse impacts and given a priority ranking. Those unsurfaced roads which are currently stable with low impacts from a sedimentation standpoint are categorized according to the type of work recommended to address anticipated impacts of future actions such as a timber sale. These roads are ranked low priority. The 22-4-6.0 road is an example of a low priority road. It is located on a ridgetop behind lock gates. It is not receiving traffic and is revegetating nicely with grasses. The categories and the roads listed under them are given in the Restoration Oppormnities and Management Recommendations section on pages 8-4 and 8-5.

3. Harvest Area Inventory from 6/89 to 6/94

To obtain a picture of the extent of recent timber-related disturbances in the WAU the lands which were harvested between the last two aerial photo flights were mapped on the one inch to the mile BLM road maps. Not all of these lands were clearcut. The percent canopy cover removed was visually estimated. In general little or no canopy remained in skyline operations, In many tractor yarding operations cutting was often more selective. Apparently hardwoods or the smaller conifers were often left standing. The positive effects of the larger residual canopy cover were often offset by the impacts of skidding trails.

Table 6-5 Harvest Activities 6/89-6/94

	Acres Harvested 6/89 to 6/94	Total Acres in Subwatershed	Percent of Area Harvested b/89 to 6194
Dodge Camp	950	9973	9.5
Elkhead	1900	22624	8.4
Lower Pass	2060	22510	9.2
Putnam Valley	2620	24156	10.8
Upper Elk	1340	14700	9.1
Upper Pass	2980	17374	17.2
Yoncalla	870	18928	4.6
East Elk Creek	12720	130265	9.8

Table 6-6 Harvest Activities, BLM YS Private

	Acres Harvested 6/89 to 6/94		Percent of Area Harvested 6/89 to 6/94	
	BLM	Private	BLM	Private
Dodge Camp	0	950	0	10.9
Elkhead	580	1320	9.1	8.1
Lower Pass	0	2060	0	10.1
Putnam Valley	280	2340	5.4	12.3
Upper Elk	80	1300	2.4	11.1
Upper Pass	80	2900	3.2	19.5
Yoncalla	0	870	0	4.9
East Elk Ck	1020	11700	4.6	10.8

Also plotted on the map from the 6/94 aerial photos were new roads or freshly reopened roads and their spurs accessing timber large enough to be cut. The assumption can be made that in 6/94 harvesting was imminent in these accessed areas.

Table 6-7 New Roads 6/94

	New spurs to unharvested timber as of 6/94
Dodge Camp	2
Elkhead	8
Lower Pass	15
Putnam Valley	12
Upper Elk	6
Upper Pass	15
Yoncalla	0
East Elk Creek	58

4. General Conclusions from Data

Most of the land in the WAU since the time of European settlement has been intensively managed, primarily in the form of agriculture, timber harvesting or a combination of the two. The percent of the land in agriculture is less than what it was in the 1930s but it still comprises a substantial percentage of the WAU. Cultivated land and pasture are generally concentrated along the floodplains and nonirrigated rangeland in the sloping upland sights.

Because field observations were limited to what can be seen from the road enroute to BLM managed lands, the degree of adverse soil impacts to water quality on these agricultural lands is speculative. Recent landslide activity appears to be negligible. However, there does appear to be widespread unsurfaced roads and trails which could be collectively important sources of sediment. Only a few small areas could be identified on the aerial photos which appeared to have active gully erosion. Livestock grazing could be a serious impact especially where overgrazing in the riparian zone or trampling of stream banks occur. On the positive side, many stream banks through the agricultural lands are lined with trees and shrubs.

Timber harvesting in the WAU has been at relatively high levels during the past decade. Harvesting occurred on nearly ten percent of the land in the five year period from 6/89 to 6/94. Roughly five percent of the BLM land and eleven percent of the private land was harvested during this five year period. Judging from the number of new road spurs to unharvested timber on the 6/94 aerial photos (54) high cut levels apparently continued beyond 6/94.

Assessing the cumulative impacts of recent timber harvesting on soils is also speculative given the amount of time allotted to this watershed analysis and given the high percentage of the activity which occurred on private. Recovery of harvested units from an erosion and sediment escapage standpoint (excluding skid trails and the larger landslide scars) is generally rapid. Units on steep slopes which had hot prescribed burns would be at risk for higher in-unit erosion and slower recovery. Those units on steep slopes in The Tyee and Spencer Formations would be at higher risk for landslide activity.

A fair amount of the private land (possibly 10%) was tractor harvested between 6/89 and 6/94. Many of the resulting skid trails were probably important contributors of sediment. The unmitigated problem skid trails are probably still contributing sediment. No tractor harvesting occurred on BLM. The new roads and spurs have likely been important contributors of sediment. The practice of completely scraping out vegetation in ditchlines during maintenance is an identified erosion and sedimentation problem in the area.

The WAU has a high density of roads and trials. A density figure of 5.8 miles of road and trail per square mile is in GIS. This figure would be considerably higher if all existing roads(including old roads no longer part of the transportation system and many unmapped private roads) are taken into account. It would be even higher if most of the old bladed skid trails are accounted for. The adjusted figure for past watershed analyses in the Tyee Resource Area has been about 30 percent higher. These higher figures certainly would not represent the current transportation system but they would help give a different perspective of cumulative impacts to the hydrology.

The majority of the forested land on slopes less than 40 percent were tractor yarded in the past. A high density of skid trails (many bladed) cover these lands. Most of these trails along with many old roads are today stable and overgrown with vegetation. A small percentage of these old roads and trails are still eroding excessively, especially the ones which continue to receive traffic. The roads and trails most impacted by long-term erosion and sedimentation tend to be those unsurfaced, steep-graded ones which occur on the deeper loamy and clayey soils low in rock fragments and which continue to get traffic. The problem becomes aggravated when erosion over the years entrenches the road and trail surfaces below the natural lay of the land thereby preventing adequate drainage. Other serious drainage/erosion problems may be associated with cutslope colluvium on old unmaintained roads which fill ditchlines and culvert basins. The colluvium can cause drainage diversion onto road surfaces.

Because of extensive ground based operations, soil compaction and associated productivity loss is an important issue. Much of the agriculture land may be in a heavily compacted state (speculation). Heavy compaction on the low elevation soils of western Oregon typically persists for many years, even for forty or more years. The cumulative impacts on hydrology by compaction and by the drainage interception of roads and trails may be significant in increasing delivery of water in the wet season and may also play a role in decreasing it during the dry season. Compaction has the effect of increasing runoff through decreased infiltration. Compacted road and trail surfaces definitely facilitate runoff. It is unclear how much of a role compacted soil outside of road and trail surfaces contribute to runoff. Recent studies seem to support the theory of significantly increased winter flows.

Landslides appear to have had a relatively minor role in sediment production in the past decade compared to earlier times (based on previous watershed analyses where all of the aerial photo flights from 1959 to present were interpreted). Only 41 landslides (mostly of the shallow translational type) with unhealed or partially healed scars were detected on the 6/94 aerial photos. About 25 of these occurred during the five year period between the 6/89 and the 6/94 aerial photos. With one exception they were all associated with roads and young harvest units. Seventeen of them were medium in size and five were large. Ninety three percent of them occurred in areas mapped as the Tyee and Spencer formations. Only a few landslides were discovered in the field while field work for this watershed analysis was being done.

The reason for the relatively low number of landslides may be partly explained by the relatively low percentage of land on slopes steeper than 60 percent(17 percent), a large percentage of high cohesion soils, periods of extended drought, and better road building practices. The landslide hazard seems to be greatest on the steep slopes of the Tyee and Spencer formations.

Most small slides appear to have had minor impact on water quality. Some exceptions might be where the slides directly entered a drainage channel which flows. Most large slides appear to have had impacted streams in a direct and substantial manner. Soil productivity in the zones of depletion of these large slides may have been severely impacted if scouring went deep into the subsoils or into bedrock (based on field observations of past watershed analyses). No large debris torrents were associated with these slides.

Steepness of slope is one of the most important landslide hazard factors. The East Elk soil slope class map (**Figure 6-4**) is useful for visualizing landslide hazard distribution. Thirty five of the identified slides plotted in the 60 to 90 percent slope delineations. Six plotted in the 30 to 60 percent slope delineations. None of the slides plotted in the lower slope classes. Other important factors are the nature of the bedrock, dip of the strata, soil cohesion, and moisture. Dip is not a factor in many shallow translational slides. It is important in many deep-seated slumps. Steep headwalls are often high risk topographic positions.

The Natural Resource Conservation Service Soil Survey of Douglas County designated certain soil mapping units as having limitations due to slope stability hazard (**Figure 6-9**). The most sensitive grouping would be weakly cohesive soils on steep slopes. Nearly all of this grouping corresponds with the Tyee Formation. The soil drainage category covers soils which are moderately well to poorly drained on slopes of 12 to 30 percent. The orange category covers areas on 12 to 60 percent slopes mapped with the well drained Windy Gap series. The author at this time questions why these Windy Gap soils were included. The reason is surmised to be low cohesion.

East Elk Geology

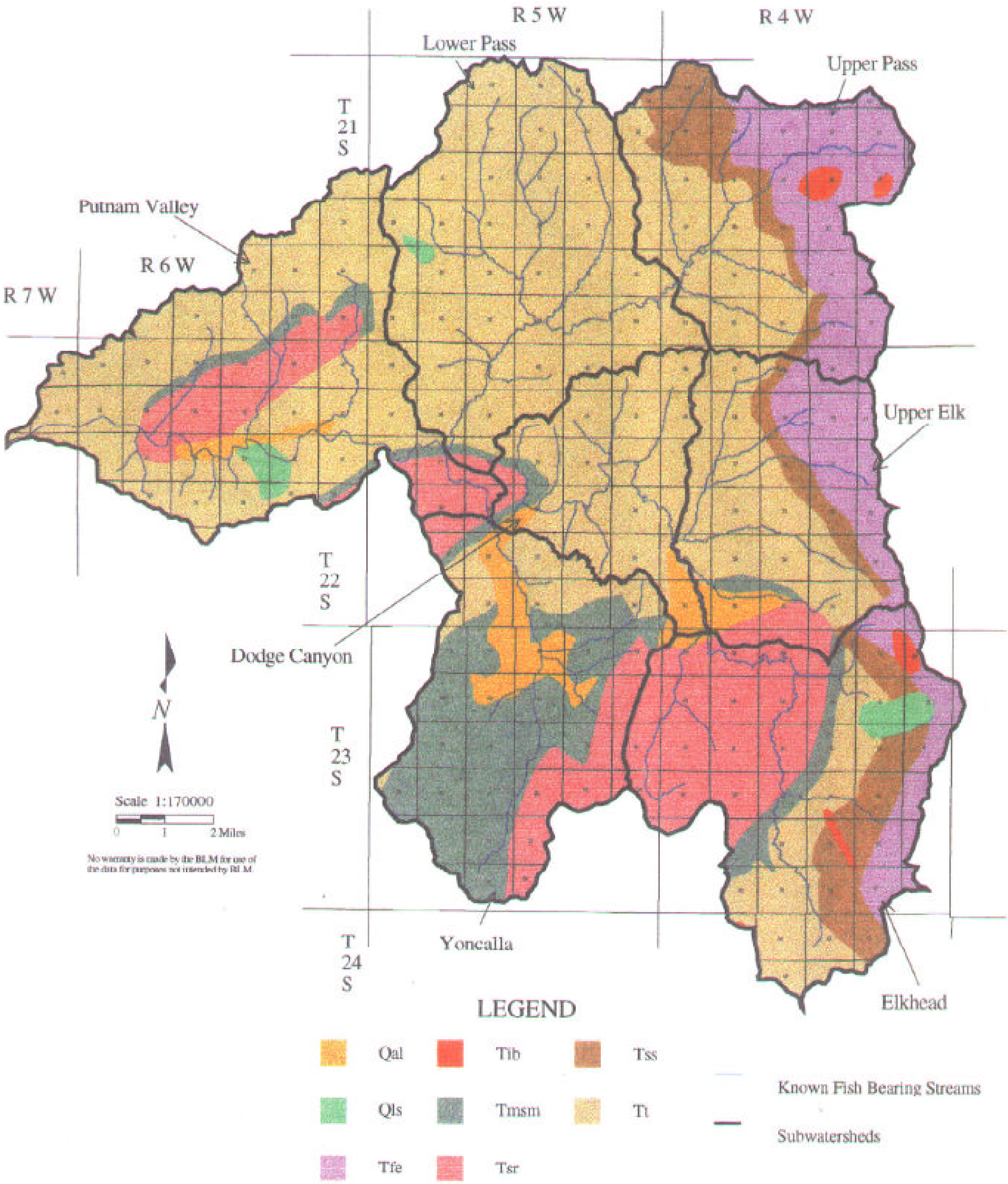
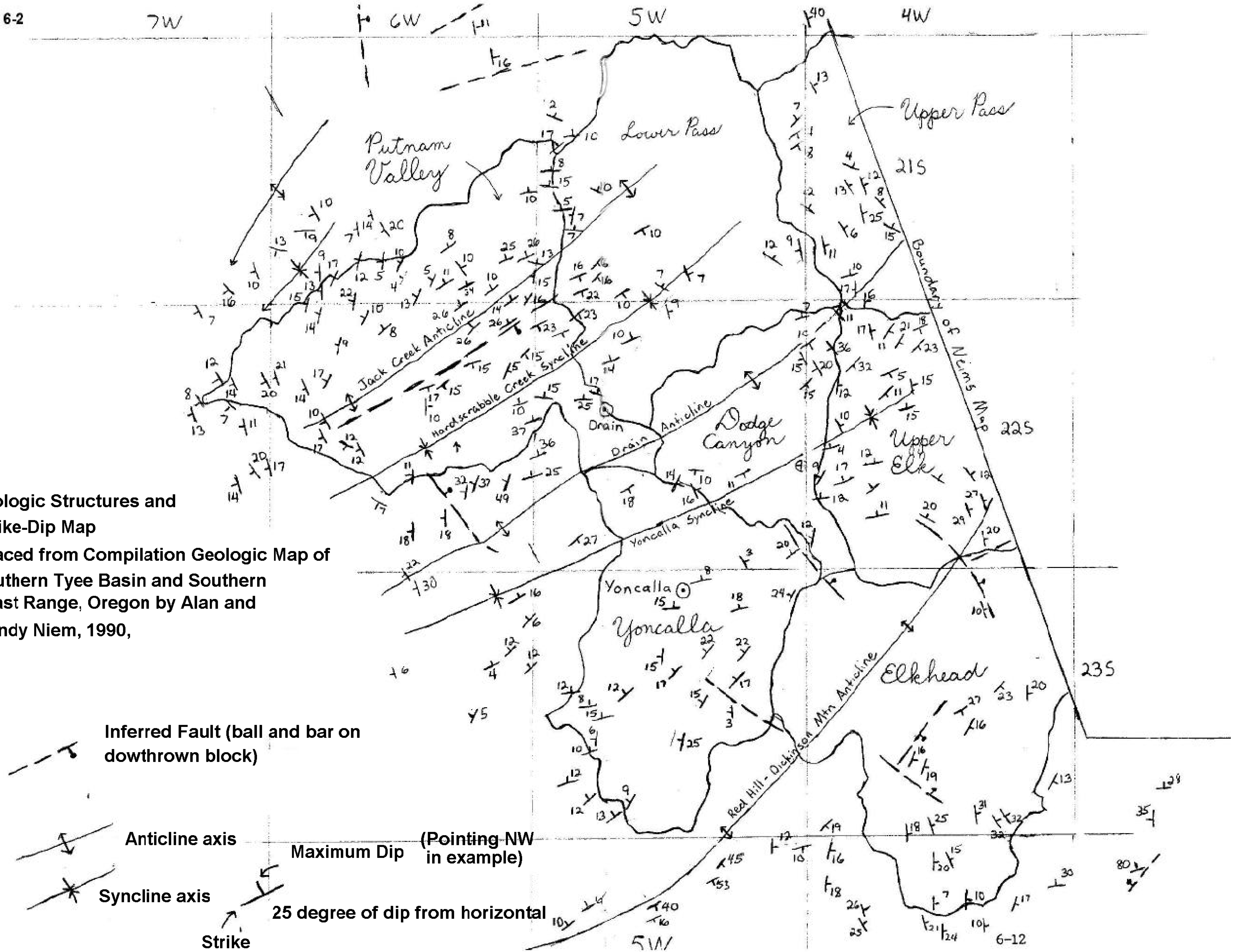


Figure 6-2



Geologic Structures and Strike-Dip Map (traced from Compilation Geologic Map of Southern Tyee Basin and Southern Coast Range, Oregon by Alan and Wendy Niem, 1990,

Inferred Fault (ball and bar on dowthrown block)

Anticline axis

Syncline axis

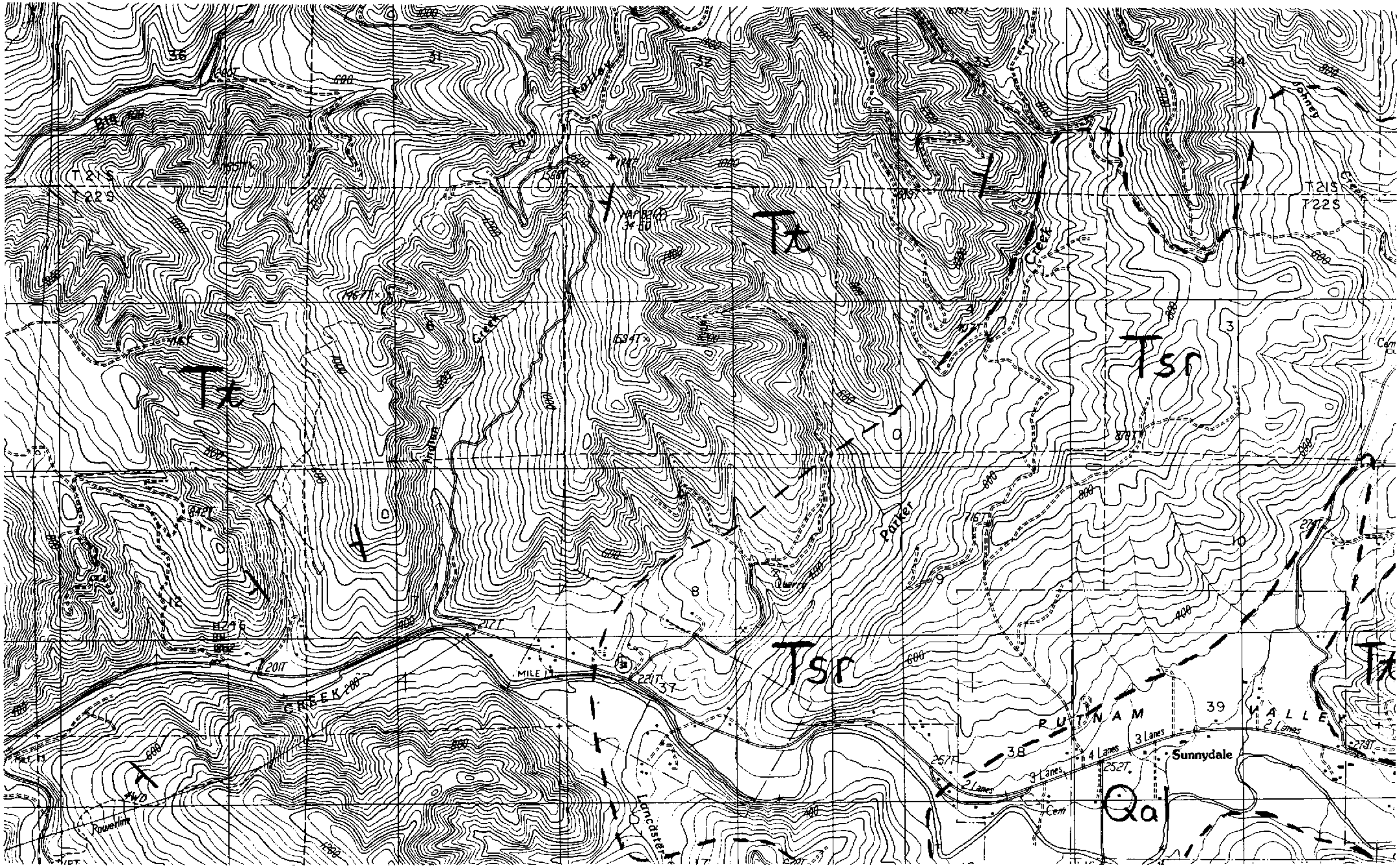
Maximum Dip (~~Pointing NW~~ in example)

25 degree of dip from horizontal

Strike

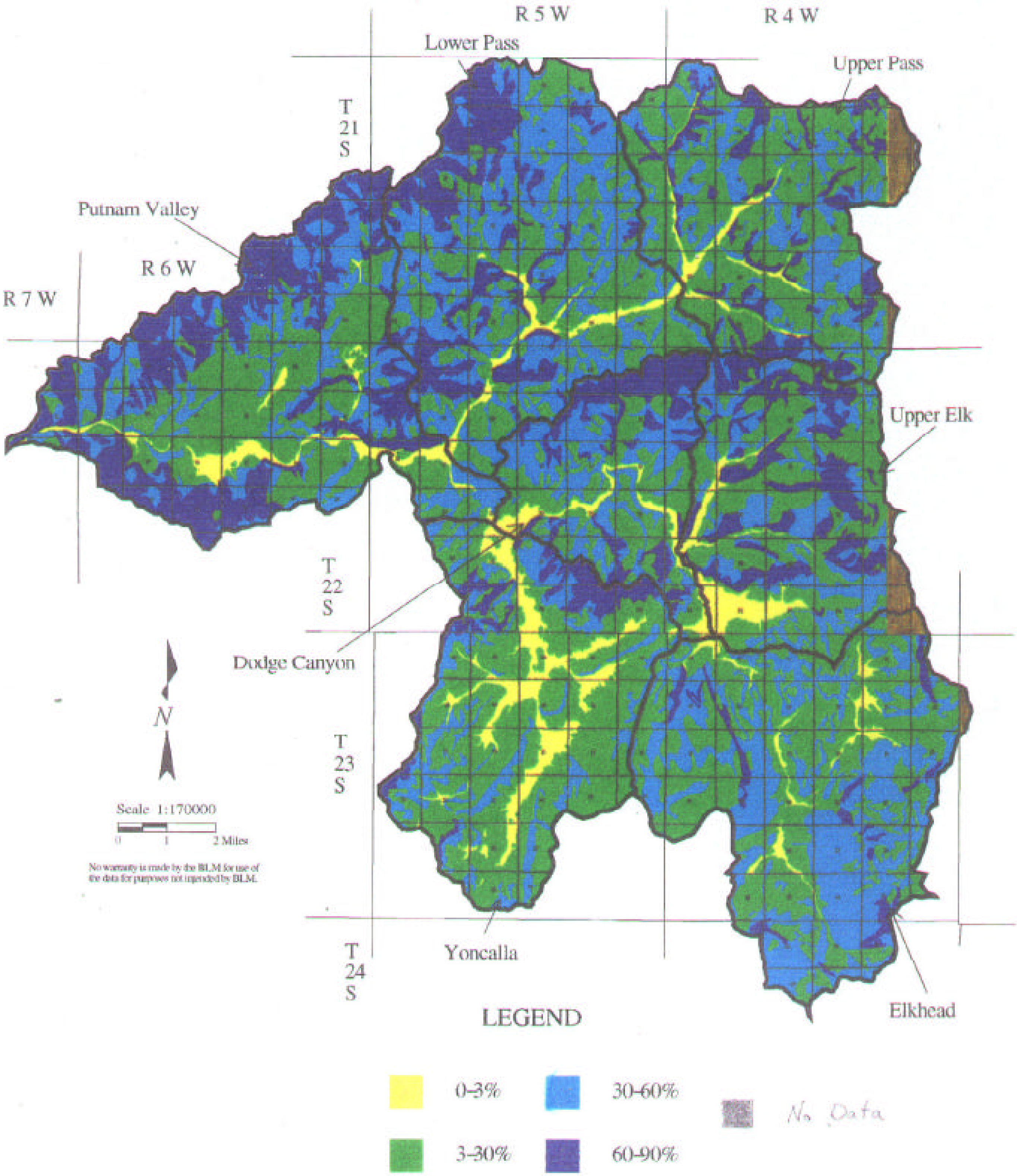
Figure 6-3

INFLUENCE ON GEOLOGY AND DIP OF STRATA ON TOPOGRAPHY



Tt = Tyee Formations
Tsr = Siletz River Volcanics

East Elk Soil Slope Classes



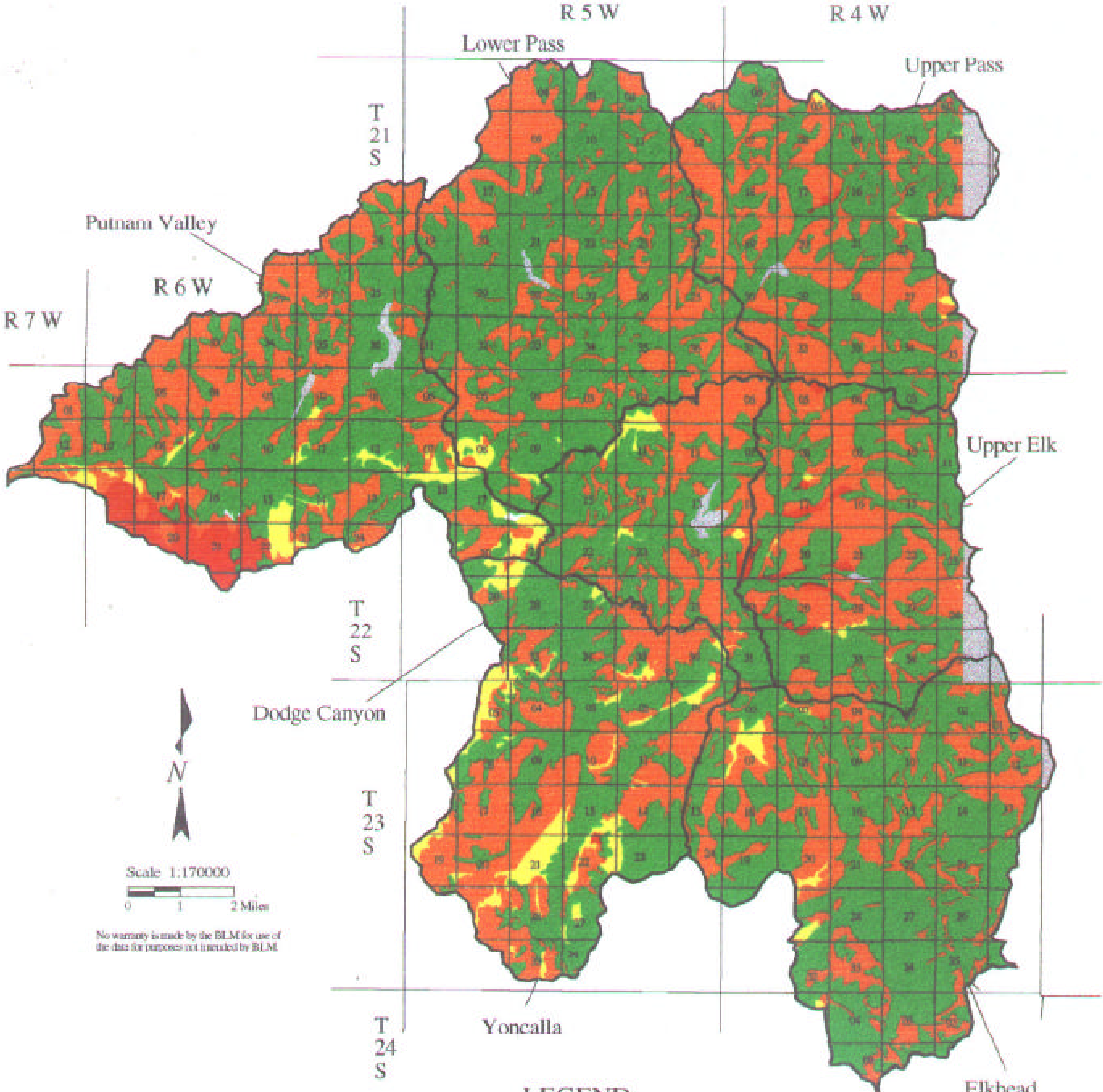
EAST ELK SOIL SLOPE CLASSIB

Soil **Slope** Classes

	Oto3k		3to30+		3akl6ok				
SUBWATERSHJ?.DS	acres	%of!md	acrea	%ofhd	acres	% ofland	acres60”	“+aofhd	I”,““,
[illegible]	876	9%	3387	34%	3510	35%	2198	22	%=1
[illegible]	1301	6%	IO&	47%	9835	43%	897	4	X5&
[illegible]	892	4%	7714	34%	9664	43%	4243	1	9”Ei
Putnam Valley	**1480**	**6%**	**8032**	**33%**	**7103**	**29%**	**7496**	**31%**	**24111**
Upper Elk	**1635**	**11%**	**6137**	**42%**	**3842**	**26%**	**3099**	**21%**	**14713**
[illegible]	1454	8%	8973	52%	4664	27%	2278	3	3%-m
Yoncalla	**2968**	**16%**	**10344**	**55%**	**4093**	**22%**	**1422**	**8%**	**18827**
EAST ELK	**10606**	**8%**	**55200**	**42%**	**42711**	**33%**	**21633**	**17%**	**130150**

Last **Mod.:6/27/96, F&s: slo&1s.wk3**

Soil Depth to Bedrock

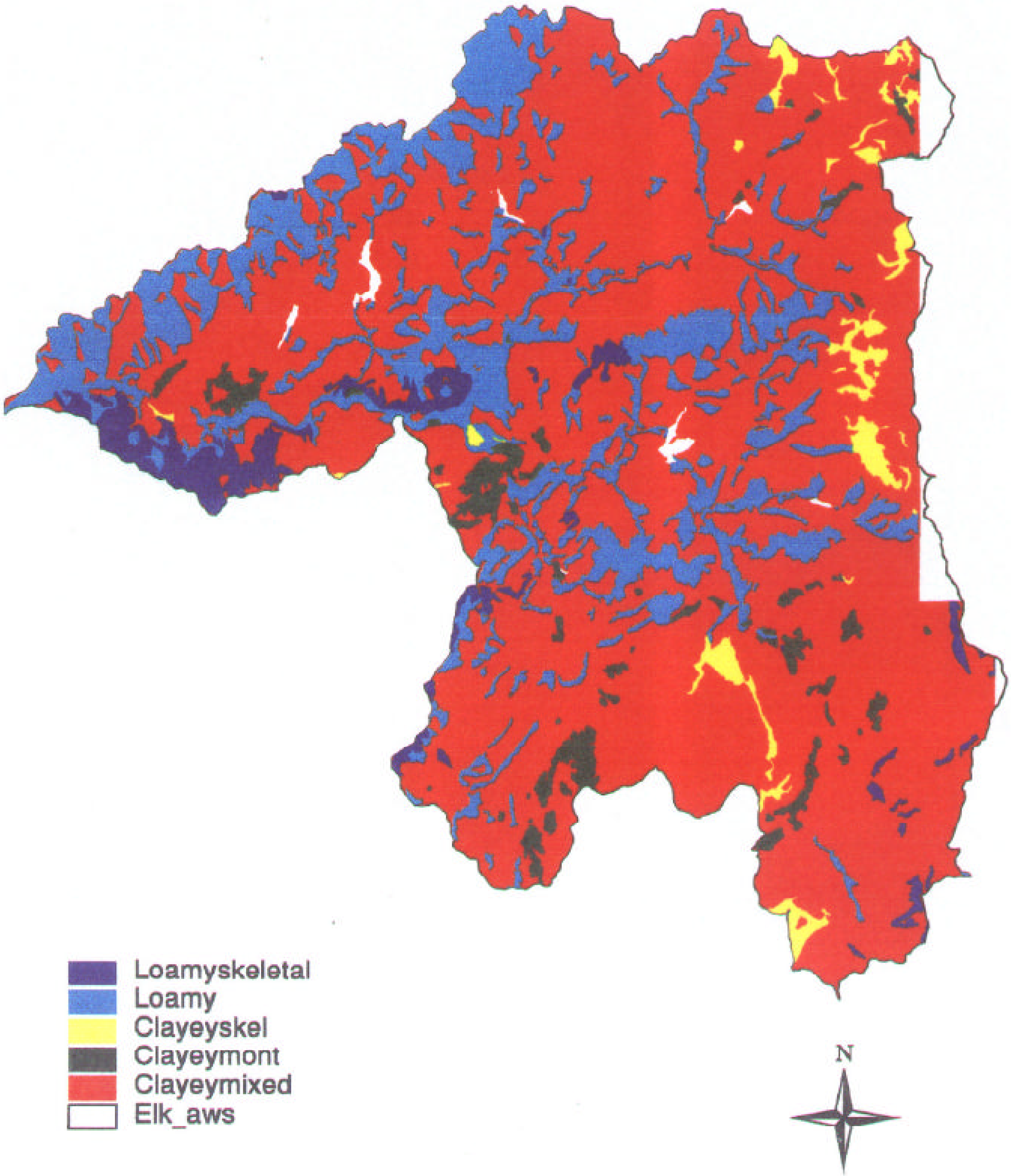


LEGEND

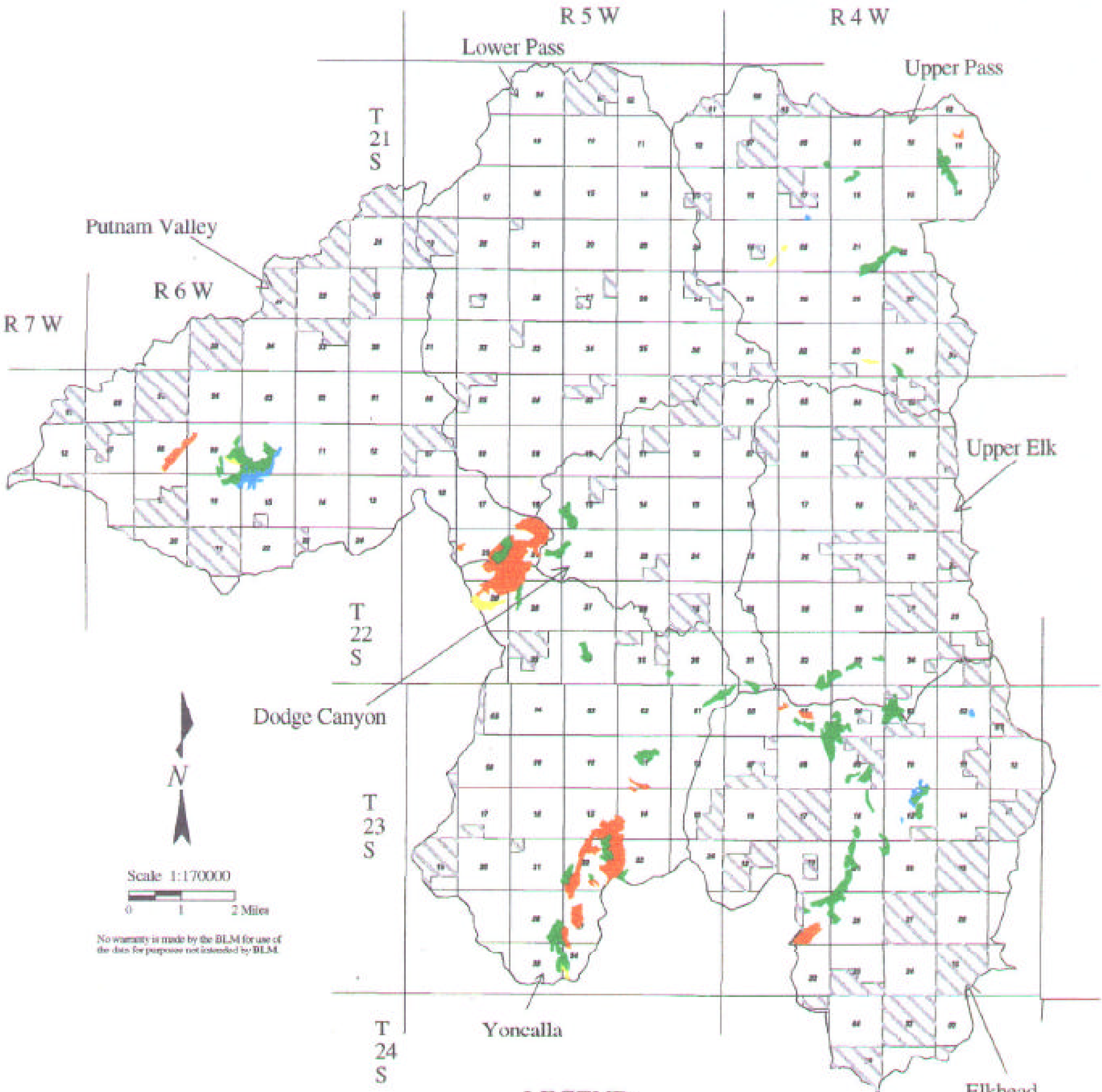
- MD -SH -RO Complexes, SH -RO Complexes
- MD -SH Complexes
- MD -VD Complexes, MD Units
- Deep -VD Complexes, Deep and VD Units
- No Data or Published Information

RO = Rock Outcrop
SH = Shallow (5 to 20 inches to bedrock)
MD = Moderately Deep (20 to 40 inches to bedrock)
Deep = 40 to 60 inches to bedrock
VD = Very Deep (greater than 60 inches to bedrock)

Elk Creek WAU
Dominant Subsoil Texture



Montmorillinitec Vertisols and Mollisols



LEGEND

- Well Drained Soils
- Moderatly Well Drained Soils
- Somewhat Poorly Drained Soils
- Poorly Drained Soils

Soil Moisture Regimes

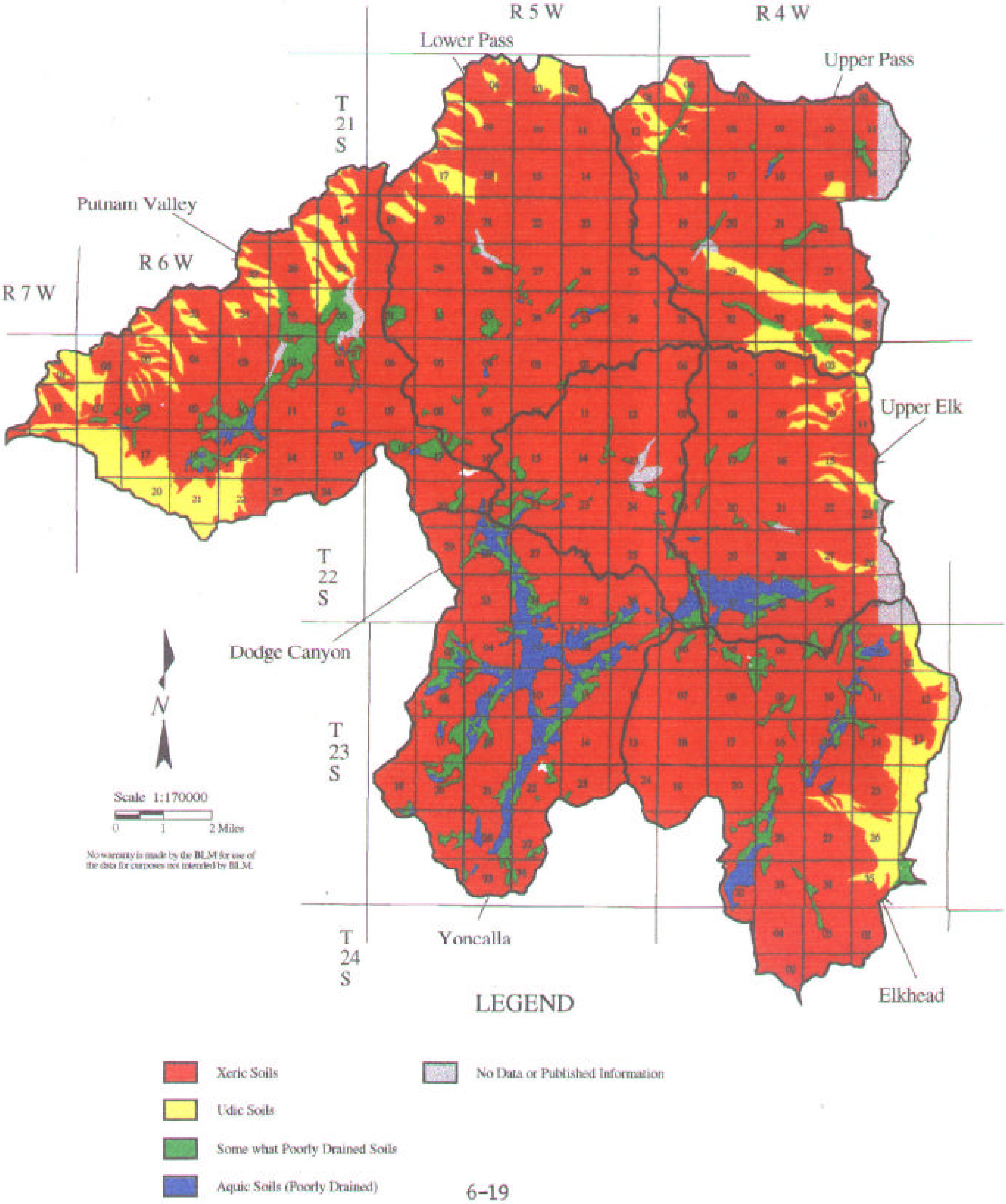
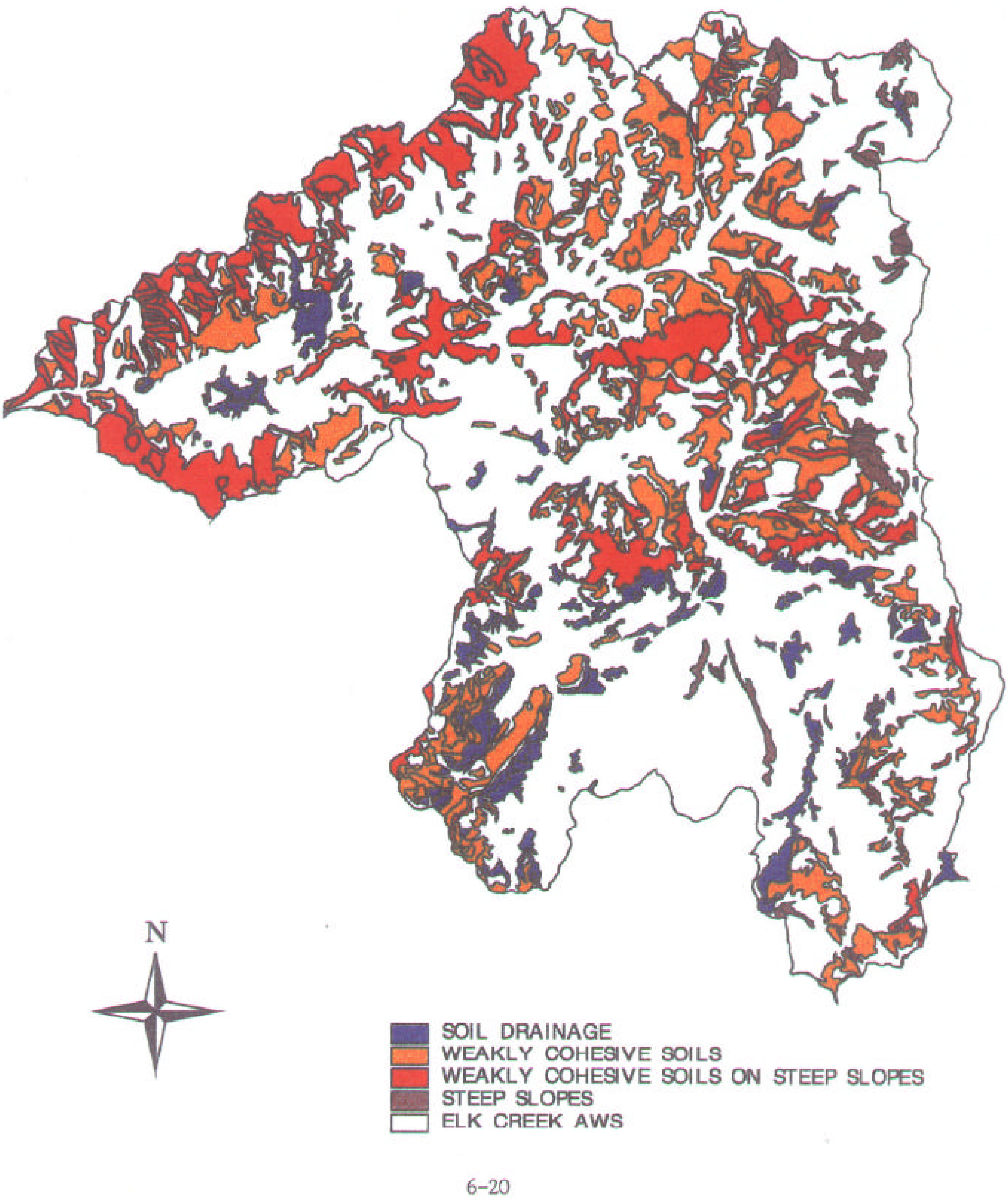


Figure 6-9

SOILS WITH SLOPE STABILITY HAZARD RATINGS



AQUATIC HABITAT AND FISH

A. Key Questions

I. Where are the key areas for at-risk fish species? Has this changed from the reference condition?

2. What is the condition of the aquatic habitat in these areas and what is the trend?

3. What are the probable limiting factors to the fish populations?

4. What risk does the road network pose to the aquatic habitats?

5. Where are the opportunities on federal lands to influence tile important aquatic habitats?

B. Findings Related to the Key Questions

1. Fish Distribution, Present and Historic

Electrofishing surveys were conducted in 1996 at various locations throughout the basin **(Figure 7-1).** Steelhead, who, cutthroat (CT), **sculpin** spp, and redside shiners were sampled. It is likely, and supported by anecdotal information, that there are some non-native, warmwater species as well.

Different areas in the basin were dominated by different species. The short, steep north flowing streams in Putnam Valley are dominated by CT. The size distribution of these populations are that of a resident fish population.

Hardscrabble Creek has the highest coho density of any of the sampled sites, but no CT or steelhead were sampled

Jack, Pheasant, and Cox Creeks have low densities of any kind of fish. Cutthroat were the only fish sampled in Adams Creek. The size structure of the CT suggests that the population is resident fish. No coho or steelhead were sampled in Adams Creek, although there appears to be suitable habitat for these species. There may be a barrier to anadromous fish downstream on private land.

Typically, a healthy anadromous fish population is one that has a variety of species represented by a variety of age classes. The most diverse fish populations are in upper Elk Creek (Elkhead) and Ward Creek (Upper Pass). Both of these sites had a mix of species and age classes. It should be noted that this is the portion of Elk Creek that will be inundated if the Milltown Hill dam is constructed.

Based on gradient and stream type, Yoncalla Creek probably had the highest historic fish densities. There is very little public land in the Yoncalla subwatershed to prove or disprove this hypothesis. Limited conversations with ODFW fisheries biologist suggest that Yoncalla Creek has a very depressed fish population.

2. Aquatic Habitat Condition

ODFW aquatic habitat surveys are available for several streams in the East Elk WAU **(Table 7-1,** Figure 7-2). All of the streams rate as “fair” to “poor”. Most of the Pass Creek system rates out overall as “poor”, with some of the tributaries “fair”. With the new stream protection rules of the Oregon State Forest Practices Act, the aquatic habitat should be improving. However, most of the private timber in the WAU is at a harvestable age, which makes the stream habitat at risk of degradation from cumulative effects.

Yoncalla Creek rates as “fair”. The land use and vegetation patterns in Yoncalla Creek have remained similar to what it was in 1936 (compare Figure 7-3, Table 7-2 with Figure **7-4, Table 7-3) (also see Chart 7-l). Therefore the stream** habitat should be stable (neither getting better nor worse).

3. Limiting Factors

There is a strong link between healthy fish populations and healthy, functioning riparian habitat. This is true regardless of the land management history. In most cases in the East Elk WAU, lack of LWD and excessive sediment seem to be the limiting factors. The lack of LWD exacerbates the potential problem of increased peak flows. The LWD creates slack water refuge areas during high winter flows. A lack of LWD causes the juvenile fish to be more susceptible to high water.

In the larger stream reaches such as lower Elk Creek, temperature and low water appear to be limiting factors in at least some years.

A limiting factor in Yoncalla Creek was not identified. Very little information was collected in the Yoncalla subwatershed because of limited federal ownership.

4. **Road Network Risks to Aquatic Habitat**

There appears to be a tremendous impact to the aquatic resources from the road network. A random culvert survey was conducted at 122 culvert sites on BLM controlled roads in the East Elk WAU (Table **7-4**). The results of this survey suggest that the road network has significantly extended the drainage network. Increases in the drainage density has the potential to alter the magnitude and frequency of storm events, which increases the exposure of juvenile fish to negative effects from high flows and also can cause long term stream channel adjustments. Of the culverts surveyed in Lower Pass, there was an average of 985 ft of ditchline per culvert that drained directly to stream channels. Also as many as 50% of the culverts in some of the subwatersheds are undersized for a 100 year flood event. Undersized culverts present another threat to the aquatic ecosystems due to their risk of failure, which can scour stream channels to bedrock or increase sediment inputs.

Diverse and high fish populations are not an indicator of the risks that are present. Recent work suggests that the most massive habitat creating/degrading processes are major storm events (greater than 10-year events) and how those events react with current watershed conditions. The threat that faces aquatic habitats is therefore related to the amount of disturbance (timber harvest and associated road building) since the last major storm event. It should be noted that the Elk Creek watershed did not experience a IO-year event in the period 1989-1994 when almost 10% of the East Elk WAU was harvested. In some cases, the most diverse populations are the most vulnerable to future degradation from past land management practices. For example, the Ward Creek drainage and the Elkhead subwatershed are the best fish areas, and they are also very vulnerable. Over 17% of the Upper Pass subwatershed has been harvested between 1989 and 1994, with more harvest scheduled since 1994. This subwatershed also has a 22.5% increase in the drainage density and about half of the culverts are in need of replacement or maintenance. The health and maintenance of isolated, diverse fish populations, such as that in Ward Creek, is critical so that these populations may serve as source populations to recolonize and seed other areas in the Upper Pass subwatershed that may be depressed due to cumulative impacts.

Furthermore, guidance from the National Marine Fisheries Service (NMFS) is to keep watershed disturbance at less than 5% per decade. This is not always feasible while also meeting our timber harvest goals under the Roseburg District Resource Management Plan. If private land is included in an analysis, every subwatershed except Yoncalla Creek has had more than 5% of the basin harvested since 1989 (Table 6-S). Elkhead and Putnam Valley are over 5% when including only federal lands. These figures could become very important when planning future timber harvest operations. Additional interpretation is needed from NMFS before using these numbers as hard guidance. However, it should be noted that the recent disturbance history may limit the BLM's harvest options in the short term.

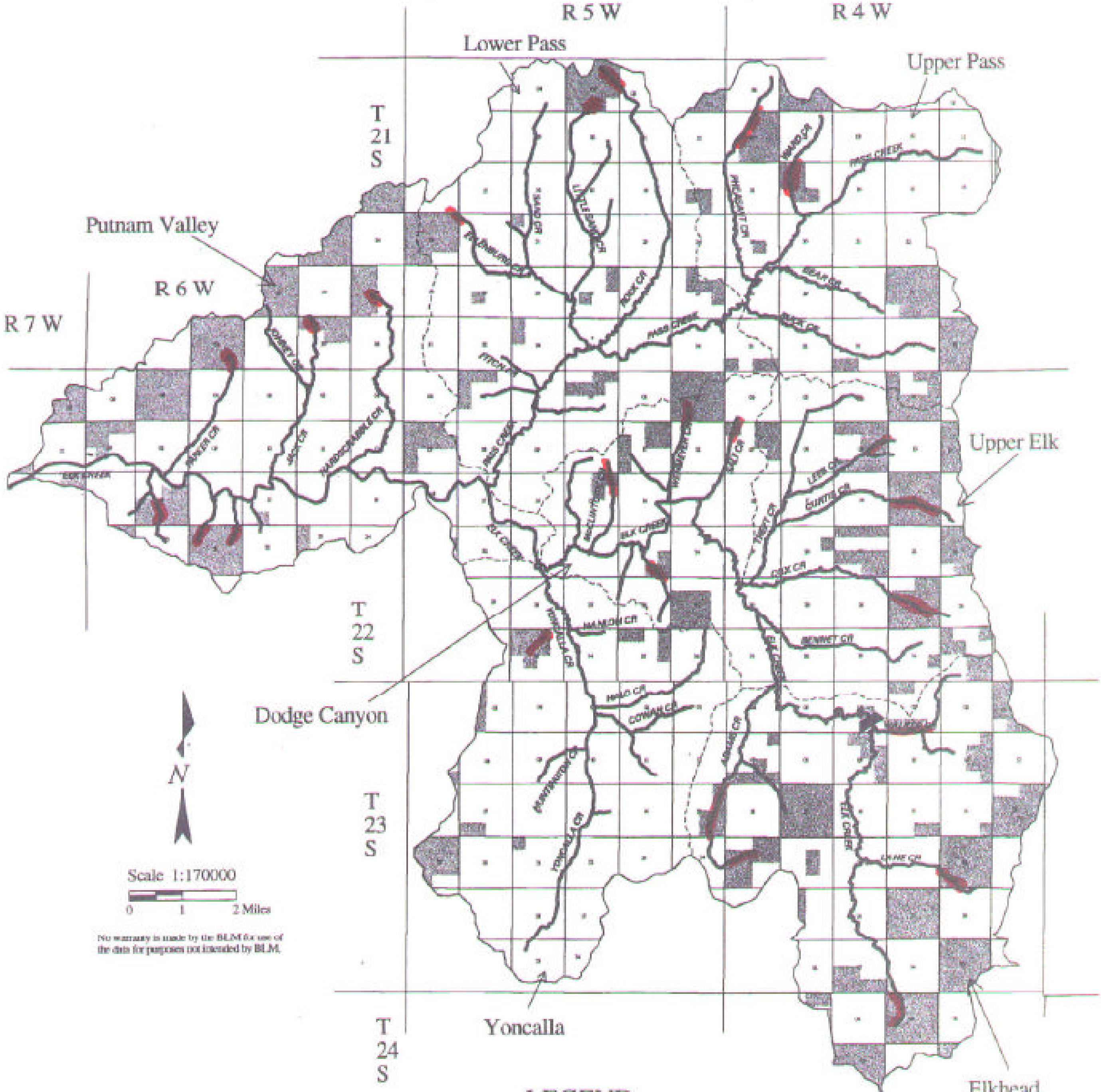
The proposed Milltown Hill dam will block at least 6 miles of coho and CT habitat, and 2.5 more miles of CT habitat. The CT habitat may also have coho, but it is not known if there is a barrier on private land.

A final note of caution needs emphasis. The survey inventories of road culverts and fish populations were conducted only on federal lands. Many of the fish surveys were conducted in the headwater stream reaches where CT are typically the only species found, regardless of the species that may be present downstream. Some of the stream reaches that are dominated by CT may be so because of their location in a particular stream, not because of their location in the East Elk WAU since most of the surveys were sampled in headwater reaches. Nothing that is presented for federal lands can be assumed to be true for private lands also.

See the Restoration Opportunities section for recommendations.

East Elk Main Streams

(Known Fish Distribution)



LEGEND

Location of fish sampling sites.

= sampling site

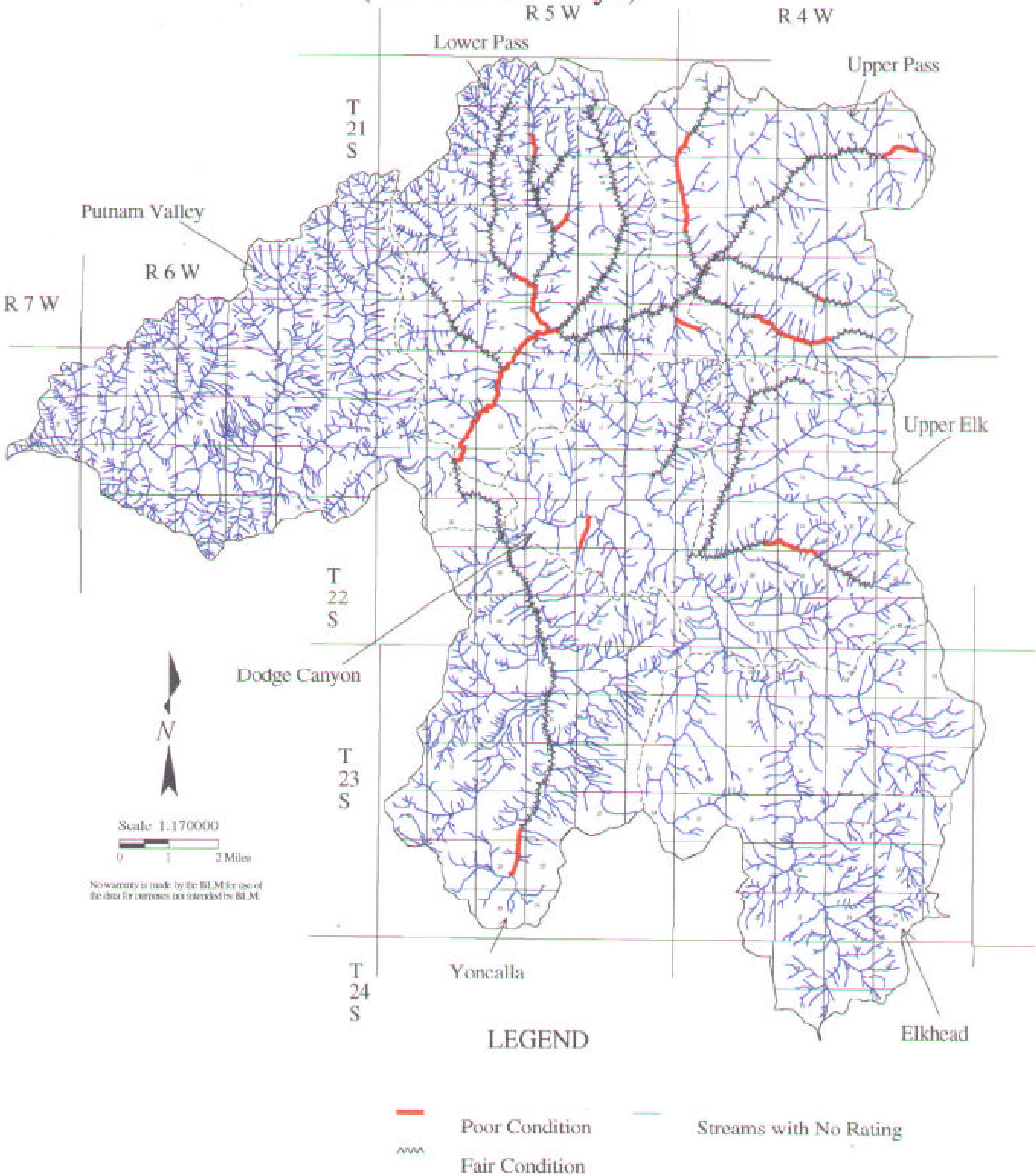
Known Fish Bearing Streams

Subwatersheds

Milltown Hill Dam

Figure 7-2

East Elk Aquatic Habitat Condition
(ODFW Surveys)

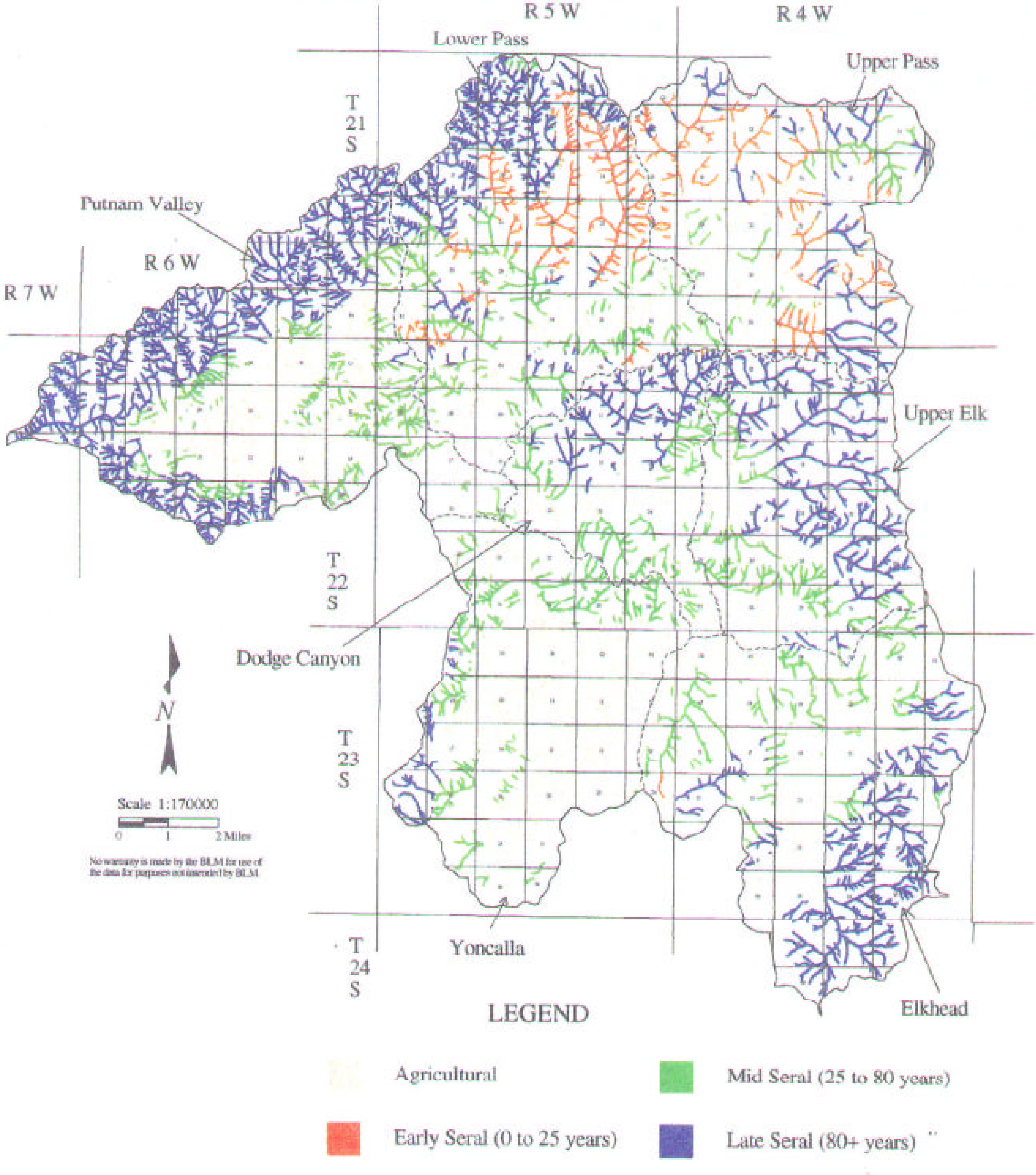


ODFW stream habitat survey data for streams in the East Elk Watershed.

	Reach	% Pool Area	Residual Pool Depth (m)	Riffle W/D Ratio	% Fines in Riffles	% Gravel in Riffles	Riparian Vegetation (dom/sub-dom)	Riparian Conifer Size	% Shade	LWD pieces per 100m	LWD vol per 100m
Asker Creek	1	13.1	0.2	27.2	24	44	hdwd/con	small	86	8.4	24
Bear Creek	1	35.7	0.5	24.1	26	48	hdwd/con	small	46	1.4	0.5
	2	23.7	0.4	33.1	30	50	hdwd/con	medium	73	7.3	7.5
	3	21.2	0.4	26.3	23	51	hdwd/con	small	94	15.6	28.5
Buck Creek	1	91.2	0.6	52.1	32	41	hdwd/con	small	60	6.2	2.5
	2	27.3	0.4	39.8	19	34	hdwd/con	small	70	6.6	6.3
	3	6.5	0.3	22.4	23	48	hdwd/con	small	85	22.7	51.5
Cox Creek	1	41.3	0.6	51.8	21	40	hdwd/con	small	72	3.9	3.2
	2	18.9	0.4	79.6	17	29	hdwd/con	medium	70	6.4	6.1
	3	21.6	0.4	54.7	15	30	hdwd/con	small	83	5.9	5
	4	62.6	0.3	49.2	19	38	hdwd/con	small	87	10.7	42.6
Curtis Creek	1	55.8	0.6	56.7	18	44	hdwd/con	small	65	5.6	8.5
	2	67.1	0.5	47	43	58	hdwd/con	small	62	5.8	5.6
	3	63.9	0.5	30.9	38	49	con/hdwd	small	66	2.6	2.1
	4	84.6	0.3	10.9	47	41	hdwd/con	small	76	2.5	14.1
Fitch Creek	1	42.2	0.4	30.4	25	60	hdwd/con	small	66	5.5	4.7
	2	77.6	0.4	17.4	54	36	hdwd/con	small	71	2.3	2.4
Little Sand Creek	1	23.4	0.6	31.1	27	48	hdwd	----	82	6.2	1.2
	2	27.5	0.6	28.7	33	30	con/hdwd	medium	87	8.4	3.4
	3	6.0	0.4	25.7	51	25	hdwd/con	small	88	18.5	17.1
	4	15.3	0.2	----	53	24	con/hdwd	small	64	15.9	12.7
Meadow Creek	1	6.7	0.4	40.5	35	19	hdwd/con	medium	96	10.4	4.4
Pass Creek	1	58.9	0.6	29.7	19	33	hdwd/con	small	42	6.2	5.4
	2	46.9	0.6	35.2	22	41	hdwd/con	small	44	5.4	6.6
	3	74.3	0.9	48.4	22	42	hdwd/con	small	64	5.4	5
	4	62.3	0.6	45.3	22	41	hdwd/con	small	65	4	3.6

	5	69.2	0.6	50.6	32	58	hdwd/con	small	71	4.2	4.5
	6	47.9	0.5	43.4	18	50	hdwd/con	small	86	3.6	5.9
	7	63.6	0.4	34.1	16	26	hdwd/con	small	65	1.0	1.9
Pass Creek Trib 1	1	71.8	0.3	19.8	55	40	hdwd/con	small	83	2.4	0.3
	2	7.1	0.1	98.6	42	47	hdwd/con	small	78	5	6.7
Pheasant Creek	1	68.4	0.5	22.5	47	49	hdwd/con	small	63	8.9	10.1
	2	43.8	0.3	37.4	23	35	hdwd/con	medium	61	6.8	6.4
	3	94.5	0.5	15.9	59	41	hdwd/con	small	42	6.1	5.6
	4	64.1	0.3	11.4	38	33	hdwd/con	medium	92	4.5	5.4
Rock Creek	1	47.8	0.5	15.1	55	27	hdwd/con	small	59	7.8	3.2
	2	24.2	0.4	26.8	19	30	hdwd/con	small	64	3.8	9.5
	3	29.2	0.4	24.4	30	36	hdwd/con	small	64	7	18.6
	4	44.5	0.3	27	18	70	hdwd/con	small	74	16.2	32.4
Salt Creek	1	37	0.5	19.7	27	60	hdwd/con	small	50	7.2	6.1
	2	76	0.5	38.9	26	41	hdwd/con	medium	59	7.9	12.9
	3	86.3	0.5	15.5	16	76	hdwd/con	small	55	11.4	22.4
	4	82.7	0.3	21.3	54	42	hdwd/con	medium	31	14.4	50
Big Sand Creek	1	30.3	0.8	43.9	23	26	hdwd/con	small	75	2.4	0.9
	2	11	0.6	36.3	22	37	hdwd/con	small	88	3.5	2.3
	3	83.6	0.4	17.2	82	5	hdwd/con	small	82	11.6	13.6
	4	29.4	0.8	----	90	7	hdwd/con	small	95	12.5	10.6
Big Sand Creek Trib 1	1	24.1	0.4	15.2	34	25	con/hdwd	medium	87	21	16.4
Taylor Creek	1	13	0.5	17.2	29	51	con/hdwd	small	92	6.7	2.8
	2	2.9	0.3	14.3	44	24	con/hdwd	small	95	10.9	9.7
Yoncalla Creek	1	90.3	0.7	12.2	37	37	hdwd/con	small	67	1.5	1.5
	2	----	---	----	--	--	-------	------	--	----	---

East Elk 1936 Vegetation Types
Within 100 Feet of Streams

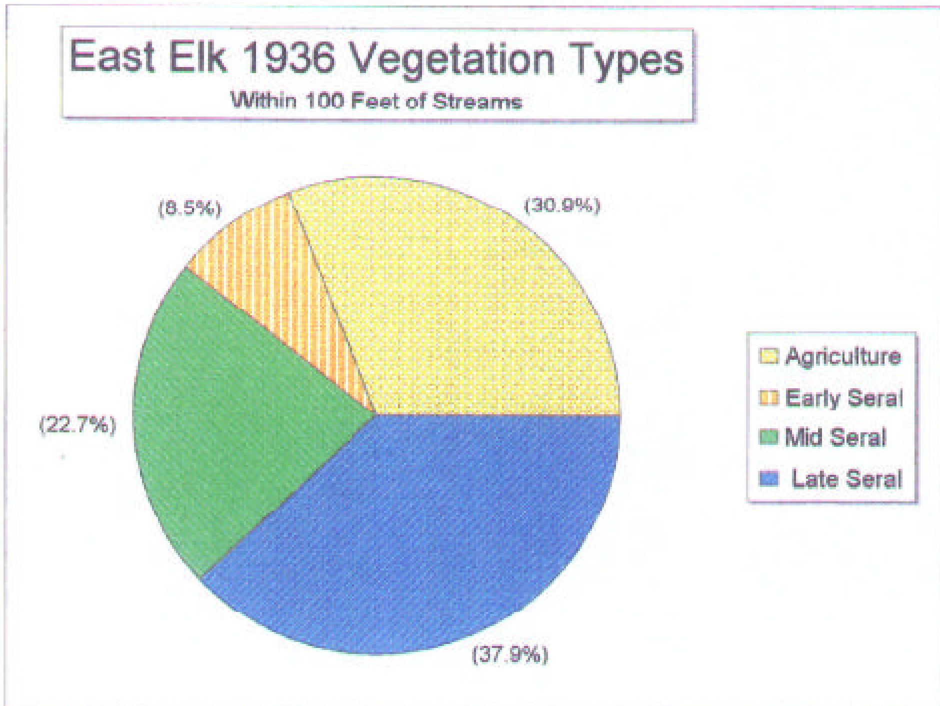


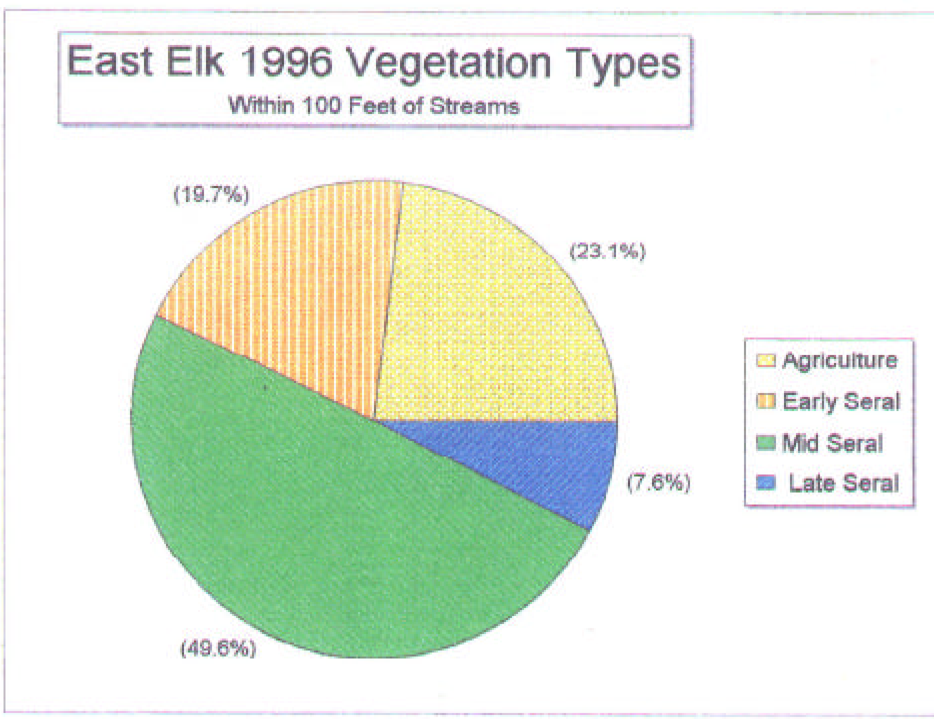
EAST ELK 1936
EARLY, MID, LATE SERAL AGE CLASSES &AGRICULTURE WITHIN 100 FEET OF STREAMS
(According to 1936 Type Maps)

Drainages / Subwatersheds	Agriculture (acres)	%	0 to 6" DBH: Early Seral (acres)	%	6 to 20" DBH: Mid-Seral (acres)	%	> 20" DBH: Late Seral (acres)	%	TOTAL ACRES
30 Elk	274	56%	0	0%	204	42%	7	1%	485
McClintock	171	32%	0	0%	263	50%	97	18%	531
Wehmeyer	41	6%	7	1%	124	17%	553	76%	724
Dodge Camp	486	28%	7	0%	591	34%	657	38%	1741
Adams	128	26%	14	3%	235	49%	105	22%	482
E. Milltown	80	71%	0	0%	33	29%	0	0%	114
Elkhead	78	34%	0	0%	2	1%	148	65%	228
Elkhead Mines	70	17%	0	0%	52	13%	288	70%	410
Milltown	376	57%	0	0%	199	30%	82	13%	656
N. Milltown	68	57%	0	0%	45	38%	6	5%	120
Shingle Mill	1	0%	0	0%	0	0%	668	100%	669
Walker	228	30%	0	0%	258	33%	287	37%	774
Elkhead	1029	30%	14	0%	824	24%	1586	46%	3453
Ellenburg Cr	11	2%	49	11%	114	25%	284	62%	459
Fitch Cr	129	25%	110	21%	199	38%	82	16%	519
Little Sand	7	1%	323	45%	66	9%	317	44%	713
Lower Pass	206	42%	0	0%	223	46%	56	12%	485
Middle Pass	304	47%	47	7%	274	43%	16	3%	641
Rock Cr	53	8%	451	66%	3	0%	177	26%	684
Sand Cr	14	2%	172	18%	136	14%	634	66%	956
Lower Pass	724	16%	1152	26%	1014	23%	1567	35%	4457
Drain	200	37%	0	0%	346	63%	0	0%	546
Hardscabble	352	25%	0	0%	377	26%	701	49%	1430
Indian Cr	1	0%	0	0%	2	0%	518	99%	522
Jack Cr	454	42%	0	0%	113	10%	519	48%	1086
Lancaster Cr	29	7%	0	0%	33	8%	372	86%	435
Middle Elk	211	61%	0	0%	29	8%	106	31%	346
Parker Cr	94	10%	0	0%	170	18%	683	72%	947
Sunnydale	442	50%	0	0%	126	14%	322	36%	890
Putnam Valley	1782	29%	0	0%	1196	19%	3222	52%	6201
Cox Cr	100	16%	0	0%	75	12%	459	72%	634
Curtis Cr	10	3%	0	0%	37	12%	256	85%	303
Lee's Cr	1	0%	0	0%	18	6%	270	93%	289
Scotts Valley	259	34%	0	0%	400	53%	103	13%	762
Thiel Cr	72	14%	0	0%	118	24%	305	62%	495
Upper Elk	441	18%	0	0%	648	26%	1393	56%	2482
Bear Cr	85	20%	188	44%	35	8%	124	29%	431
Buck Cr	164	30%	123	22%	45	8%	215	39%	546
Pheasant Cr	111	21%	306	57%	47	9%	72	13%	536
Upper Pass	46	8%	201	34%	195	33%	140	24%	582
Ward Cr	61	38%	65	40%	6	3%	30	18%	162
Upper Pass	468	21%	882	39%	328	14%	581	26%	2257
Cowan Cr	452	98%	0	0%	11	2%	0	0%	463
Devore Mtn	529	57%	0	0%	331	36%	68	7%	928
Halo Cr	397	55%	0	0%	322	45%	0	0%	719
Huntington Cr	355	58%	0	0%	133	22%	128	21%	616
Rice Hill	839	88%	0	0%	114	12%	0	0%	953
Yoncalla	2572	70%	0	0%	911	25%	196	5%	3679
EAST ELK	7503	31%	2055	8%	5511	23%	9200	38%	24269

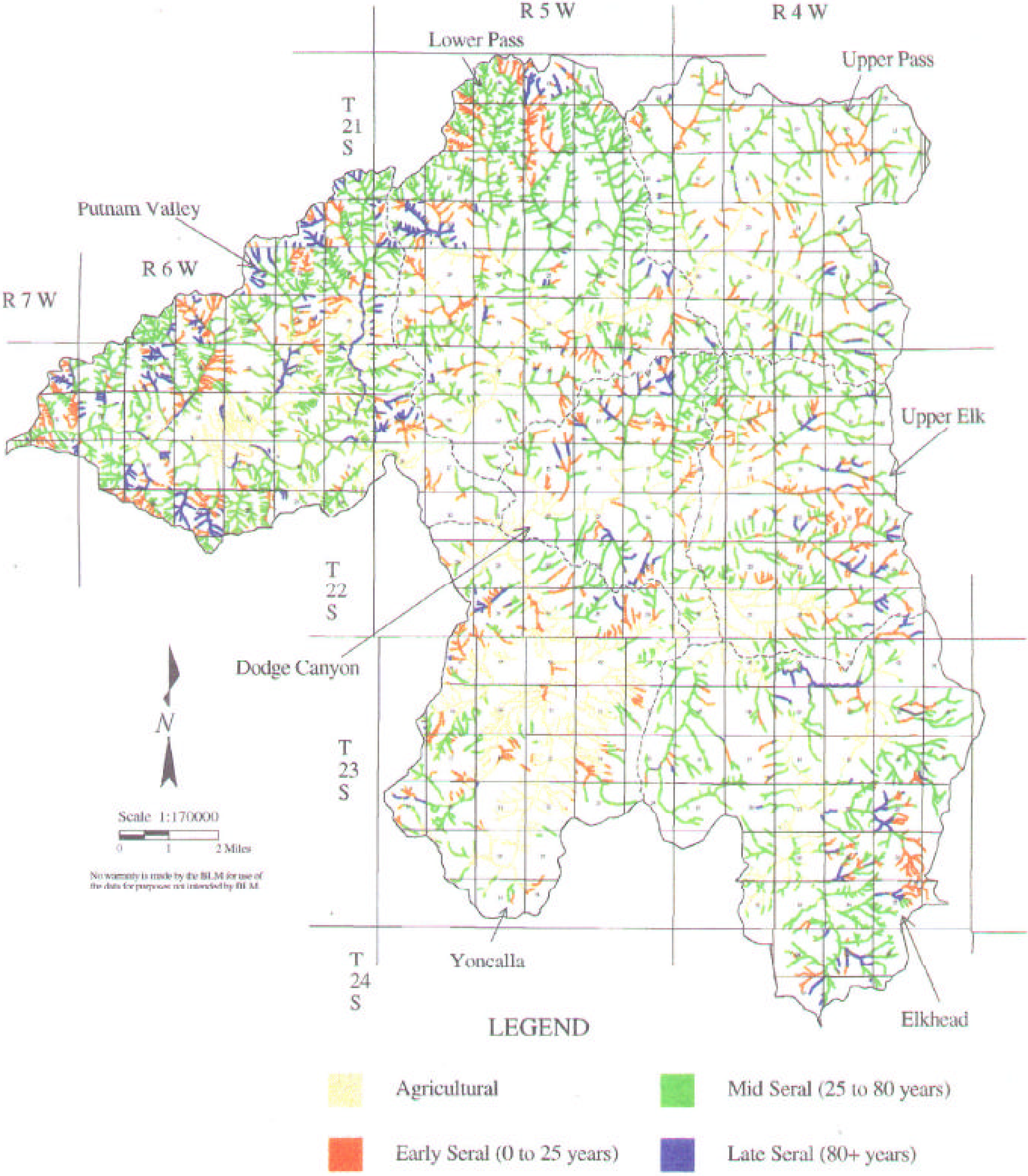
LAND TYPES & SERAL AGE CLASSES (by diameter class - DBH)

Last Mod.: 7/2/96, File: buf36veg.wk3


East Elk 1936 Vegetation Types
Within 100 Feet of Streams
(8.5%)
(30.9%)
(22.7%)
(37.9%)
Agriculture
Early Seral
Mid Seral
Late Seral


East Elk 1996 Vegetation Types
Within 100 Feet of Streams
(19.7%)
(23.1%)
(7.6%)
(49.6%)
Agriculture
Early Seral
Mid Seral
Late Seral

East Elk 1996 Vegetation Types
Within 100 Feet of Streams



EAST ELK 1996
EARLY, MID, LATE SERAL AGE CLASSES &AGRICULTURE
WITHIN 100 FEET OF STREAMS
(According to 1989 & 1993 aerial & satellite photos on private lands, Forest Inventory on Federal lands)

Drainages / Subwatersheds	Agriculture (acres)	%	0 to 6" DBH Early Seral (acres)	%	6 to 20" DBH Mid-Seral (acres)	%	> 20" DBH Late Seral (acres)	%	TOTAL ACRES
30 Elk	183	39%	91	19%	174	37%	26	5%	473
McClintock	170	32%	109	20%	213	40%	39	7%	531
Wehmeyer	29	4%	171	24%	441	61%	84	12%	724
Dodge Camp	382	22%	371	21%	828	48%	149	9%	1729
Adams	42	9%	42	9%	388	80%	11	2%	482
E. Milltown	38	37%	0	0%	65	63%	1	1%	105
Elkhead	48	21%	64	28%	91	40%	25	11%	228
Elkhead Mines	52	13%	132	32%	170	42%	55	13%	410
Milltown	243	38%	36	6%	322	51%	32	5%	633
N. Milltown	54	45%	4	4%	48	40%	13	11%	120
Shingle Mill	12	2%	126	19%	453	68%	79	12%	669
Walker	173	22%	110	14%	423	55%	68	9%	774
Elkhead	662	19%	514	15%	1960	57%	284	8%	3420
Ellenburg Cr	54	12%	103	22%	179	39%	122	27%	459
Fitch Cr	105	20%	144	28%	256	49%	13	3%	519
Little Sand	42	6%	181	26%	433	62%	45	6%	701
Lower Pass	111	24%	111	24%	227	50%	8	2%	457
Middle Pass	169	26%	168	26%	259	40%	45	7%	641
Rock Cr	32	5%	43	6%	590	86%	20	3%	684
Sand Cr	36	4%	216	23%	692	72%	11	1%	956
Lower Pass	549	12%	966	22%	2636	60%	264	6%	4417
Drain	134	27%	108	22%	204	41%	50	10%	497
Hardscabble	188	13%	209	15%	806	56%	226	16%	1430
Indian Cr	26	5%	127	24%	303	58%	64	12%	519
Jack Cr	237	22%	163	15%	558	52%	124	11%	1081
Lancaster Cr	19	4%	116	26%	247	56%	60	14%	442
Middle Elk	54	17%	32	10%	224	68%	17	5%	328
Parker Cr	54	6%	284	30%	466	49%	139	15%	943
Sunnydale	291	34%	120	14%	331	38%	127	15%	868
Putnam Valley	1003	16%	1160	19%	3138	51%	807	13%	6109
Cox Cr	61	10%	201	32%	300	47%	72	11%	634
Curtis Cr	45	15%	137	45%	90	30%	31	10%	303
Lee's Cr	10	4%	47	16%	201	70%	30	10%	289
Scotts Valley	316	42%	113	15%	299	39%	32	4%	760
Thiel Cr	53	12%	115	26%	269	61%	1	0%	439
Upper Elk	485	20%	613	25%	1160	48%	166	7%	2424
Bear Cr	80	19%	84	19%	236	55%	31	7%	431
Buck Cr	87	16%	64	12%	346	65%	39	7%	536
Pheasant Cr	73	14%	148	28%	302	56%	12	2%	536
Upper Pass	46	8%	158	28%	362	63%	4	1%	571
Ward Cr	43	27%	29	18%	85	53%	4	2%	161
Upper Pass	331	15%	482	22%	1332	60%	90	4%	2234
Cowan Cr	337	78%	31	7%	65	15%	0	0%	433
Devore Mtn	431	47%	203	22%	243	27%	41	4%	918
Halo Cr	353	49%	163	23%	190	26%	12	2%	719
Huntington Cr	311	50%	108	18%	182	30%	15	2%	616
Rice Hill	690	75%	98	11%	137	15%	0	0%	925
Yoncalla	2122	59%	605	17%	818	23%	68	2%	3611
EAST ELK	5536	23%	4709	20%	11873	50%	1827	8%	23944

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Table 7-4

Estimated ditchflow, adequacy and condition from a random survey of 122 federally controlled culverts in the East Elk watershed.

Sub-Watershed	# Culverts surveyed	Estimated miles of ditchflow into streams	Estimated % increase in the drainage density	# Inadequate for Q10	# Gun barrels	# Needing maintenance
Elkhead	49	23.7	16.2	25	7	18
Yoncalla	5	23.1	14.7	3	0	2
Dodge Canyon	6	15.1	20.4	0	0	1
Upper Elk	22	13.4	12.8	9	2	4
Lower Pass	4	50.3	26.5	2	0	3
Putnam Valley	21	38.3	14.4	9	2	7
Upper Pass	15	21.4	22.5	4	1	7
East Elk	122	185.3	18.0	52	12	42

RESTORATION OPPORTUNITIES AND MANAGEMENT RECOMMENDATIONS

The following recommendations are for the most part directed at processes that are within the influence of the BLM on federally administered lands. For those processes that may affect beyond property lines, only general recommendations are made. In order to further address/define the land use objectives and management trade-offs within the Elk Creek WAV, a cooperative effort would need to occur among the various private landowners and state agencies. Also these recommendations are given with the realization that other watersheds, such as Tom Folley (Smith River), Rock Creek, and Canton Creek, will have a higher funding priority for restoration. It is assumed that most funding for restroration in East Elk WAU will come from revenue generating projects (ie. timber sales) or from mitigation funding from spills of hazardous materials.

A. Human Uses/Fire Recommendations

Due to the large percentage of private lands intermingled with the scattered BLM lands, all tires should he suppressed immediately. The DFPA provides protection activities for the BLM and industrial forest land owners. Continue with rapid initial attack efforts on all fires to protect the existing resource values, and reduce potential liability to the BLM from tire spreading on to private land. Because of the high value of roads for quickly accessing initial fires, the transportation management objectives for all roads in this WAU should take this into consideration (see Road Restoration and Transportation Management Objectives below).

All activity fuels created by logging, thinning, etc. should be treated to reduce fuel hazard and fire risk. Treatment could include burning (broadcast, handpiling, swamper), gross yarding of unmerchantable material and tops not needed to meet large woody debris requirements, lopping and scattering of tops and limbs, and other treatments to reduce activity fuels.

B. Restoration of Vegetation and Late Successional Dependent Terrestrial Wildlife Habitat

1. Distribution of LSH

In general, the most critical issue in this WAU for late successional dependent terrestrial wildlife is the widespread loss of late successional forest habitat that has occurred during the past 70.80 years. This type of habitat appears to have been present over approximately 34.46% of the landscape before the timber harvesting by white settlers began in the 1920s. Today only 7% of the landscape contains this habitat. What remains is highly fragmented and exists almost exclusively on federal lands. On BLM lands approximately 7,782 acres (36% of BLM lands) is in late successional habitat (Table 3-3).

The land ownership pattern in this WAU, with approximately 80% of the land owned and controlled by private landowners, does not lend itself to landscape-level management plans. Federal land management will have little effect on the overall vegetation pattern in the WAU, however the headwaters of several small drainages are still mostly administered by BLM and contain significant amounts of LSH. If these areas are managed with refugia in mind they could provide habitat for populations of aquatic and terrestrial wildlife into the future. These populations can potentially recolonize the downstream reaches on private lands when/if they return to suitable habitat condition.

As can be seen in Figure 9-l. depicting the distribution of stands which have late seral ages over 120 years, the majority of the older (2CO+ years), more well developed habitat is located in the Elkhead subwatershed, with a few areas in the Uv~er Elk. The areas shown as 120-200 years of age also represent important refugia habitat. especially when located in the headwaters of stream systems.

> Recommendation: Restoration projects **which** attempt to maintain, restore or develop the components of LSH in these headwater systems - such as limiting salvage, snag creation, acceleration of growth in younger stands which lie between or adjacent to old stands and road decommisioning should br encouraged and planned in the near future.

2. Owl Dispersal Habitat

The Final Supplemental Environmental Impact Statement of the Forest Plan describes the land use allocations and their overall impacts on the Northern Spotted Owl. It acknowledges that owl populations would decline over the short term In East Elk WAU the loss of dispersal habitat between provinces is important in maintaining the owl population. The following recommendations may provide additional mitigations beyond the Forest Plan for the short term maintenance of owl dispersal. Figure 4-3 gives a picture of how late successional and dispersal habitat on BLM lands link habitat to the east and west of East Elk WAU.

The relatively early harvesting history in this WAU has led to the widespread distribution of Mid Seral (25-80 years) habitat as restocked areas retom to conifer forest habitats and previously cultivated and burned agricultural areas become converted to hardwood and conifer habitats. Much of this habitat is found on private ownership and it is expected that these forests will he harvested between 50 and 70 years of age. Almost 40% of federal lands are currently in this age class **(Table 3-3).** In order to increase the likelihood that species such as the spotted owl will continue to be able to move from the Cascades Province to the Coast Range Province across this WAU, management of Mid Sew.1 stands on federal lands across the landscape should balance the need for maintaining currently functional dispersal habitat in a well distributed pattern with the need to accelerate the development of late successional seral characteristics in these stands.

> **Recommendation:** Forest habitat in the Mid Seral age range on federal lands throughout the WAU should be treated to encourage the rate of seral development. It would be most helpful if stand treatments were smaller in scale (ie. less than 300 acres) and planned out in time and space so that they are not concentrated over the landscape. This type of planning could help maintain the quality of owl dispersal over the landscape in the short term. Timing and locations of treatments should consider the condition and the probable future management of the surrounding habitat, both public and private, to **address** connectivity concerns and dispersal abilities of important wildlife species in the area.
>
> Recommendation: In the Yoncalla subwatershed, across which very little dispersal is expected to occur because of the extensive agricultural lands, stands including Mid Seral could be harvested in regenertion-type harvest regimes without advers6ly affecting dispersal for spotted owls and other large vertebrates. Volume gained by timber sales of this type would help to offset the negative effect of harvesting in late-seral stands elsewhere.

Cooperative agreements and good communication with private landowners in this WAU could ultimately result in greater benefits to wildlife habitat.

C, Aquatic/Hydrological Restoration

-Classify streams in the WAU by type using Rosgen (1994). Use this for comparison, a basis for extrapolation, prediction of stream behavior, and design of Stream enhancement structures.

-Determine bankfull discharge, meander width ratio of valleys, and belt width on all 4th order streams as needed for specific projects. Measure bankfull width, mean depth, width/depth ratio, maximum bankfull depth, entrenchment ratio, channel and valley slope, sinuosity, and~channel material. Develop curves of bankfull channel dimensions versus drainage area for the region.

-Implement bioengineered stream stabilization improvements and avoid the use of rip rap for channel stability. When possible, stabilize bank erosion in main channels by increasing streamside vegetation. Decrease peak flows by adding drainage structures to roads (drain dips, culverts) and decreasing the amount of or eliminating ditchlines. This is especially true for areas of unstable soils such as Buck creek.

-When installing new culverts do not constrict flow through a single culvert, instead install multiple culverts if necessary to match upstream width/depth ratios.

-Determine proper functioning condition of the riparian areas in the WAU on BLM administered lands.

-For the next iteration of watershed analysis redraw drainage boundaries to reflect ridge to ridge drainage (previously mentioned in the text).

-Continue the study of this WAU so that data is collected during all seasons of the year rather than the three month period in which this analysis was conducted.

D. Restoration of Aquatic Habitat and Fish

1. Key Areas for At-risk Fish Species

The Elkhead subwatershed and Ward Creek drainage have the most diverse fish populations. These areas are also the most susceptible to future degradation from the road nehvork and the recent disturbance. It is likely that the fish in these areas, if protected, could serve as a "seed" population for surrounding areas. The Hardscrabble Creek drainage has a high density of coho salmon.

> **Recommendations:** Protect areas of high species diversity and areas of key who habitat. In Elkhead subwatershed, harvest methods need to be predominantly commercial thinnings. Avoid temporary or permanent road building and defer Regeneration type harvests in the Ward Creek drainage for IS years. Work with state agencies and private landowners to determine if these species trends are true for private lands also.

2. Condition **and Trends of Aquatic Habitat**

The aquatic habitat in the WAU is in a poor to fair condition. Most of the riparian habitat on private lands is at a harvestable age, which means that the aquatic habitat may not improve as a result of the Oregon State Forest Practices Act (OSFPA). The exception is the Yoncalla subwatershed, where land use has remained similar since 1936. Most of the aquatic habitat surveys note a lack of LWD. There is a positive correlation between healthy fish populations and functioning riparian habitat. It appears from aerial photos that Hardscrabble creek would be an example of what the OSFPA practices could look like on private lands, and the fish habitat may be what can be expected from the new rules.

> **Recommendations:** Where appropriate, encourage the recruitment of LWD into the streams by thinning second growth stands. Seek areas to reclaim riparian habitat by decommissioning roads that are in riparian areas. Work with private landowners and state agencies to determine limiting factors in the Yoncalla subwatershed.

3. **Road Nehvork Risk to Aquatic Habitats**

The road network is significantly affecting the drainage density. In addition, as many as 50% of the culverts are either undersized or in need of repair.

> **Recommendations:** Begin upgrading the road system immediately to reduce sediment and peak flows. Require bringing the roads to RMP standards on all timber sales. Upgrade the road system in subwatersheds that have a high portion of reserves with restoration dollars, since timber sale dollars are not available.

Caution: All of the above findings were on federal lands. Many of the fish surveys were conducted in the headwater stream reaches where cutthroat (CT) are typically the only species found, regardless of the species that may be present downstream. Some of the stream reaches that are dominated by CT may be so because of their location in a particular stream, not because of their location in the East Elk WAU since most of the surveys were sampled in headwater reaches. Nothing that is presented for federal lands can be assumed to be true for private lands also.

Milltown Hill Dam. The dam will block at least 6 miles of coho and CT habitat, and another 2.5 miles of CT habitat based on data gathered in the summer of 1996 on BLM streams above the proposed dam site. The CT habitat may also have coho, but it is not known if there is a barrier on private land.

E. **Road Restoration and Transportation Management Objectives**

East Elk WAU is estimated to have 1,183 miles of road. Because this estimate only considers main line roads and does not take into consideration many roads on private lands, it is a low estimate. Road densities that were measured averaged 5.8 miles per mile2 For forested basins road densities with 2 miles per mile' have been shown to produce measureable cumulative effects on stream flows.

> **Recommendation:** Because of the high road densities, any new road construction on BLM lands, temporary or permanent, needs to be strictly regulated and/or limited.

In a selected sample of BLM roads analysis showed that road/stream crossings had an average of 538 feet of roadside ditchline that drained directly into streams. This is 2 to 8 times greater than the current RMP standards. This increases the drainage density, which in tllrn increases the peak flows. It was also noted that during maintenance of ditchlines, vegetation was completely cleaned out. This vegetation can help prevent erosion and reduce the amount of sediment that reaches streams.

> **Recommendations: Add** drainage structures (drain dips, culverts) to roads where they are lacking. Work **with** BLM, state, and county maintenance crews to encourage the benefits of retaining some vegetation in the ditchlines.

In this analysis the transportation management objectives were focused mostly on natural surfaced road segments and some rocked road segments that are owned and controlled by the BLM. Many of these roads arc intermingled with privately owned or controlled road segments. Transportation objectives will need to be more fully developed on a case by case basis in coordination with each individual land owner. Because of limited funds, setting transportation objectives and restoring roads in the East Elk WAU will mostly occur in conjunction with timber sale projects.

Another constraint in developing transportation objectives is the scattered BLM ownership and the need for tire access. One main recommendation is to control and suppress all fires in this WAU because of the liability across property lines, Thus there is a need to keep existing roads accessible. The following recommendations take the above constraints into consideration. They are generalized recommendations based on the current knowledge of existing conditions and would need to be refined with each individual project in coordination with private individuals and Right-of-Way holders. This list is a starting point to be further developed.

1, Natural surfaced roads across large portions of private lands needing outsloped grades where possible and development of rocked drained dips. These roads could be gated or blocked with railings to prevent erosion during wet winter months but allow fire access during the summer months. The outsloping and drain dips would lower the maintenance needs of these roads.

Road No.	Segment	Road No.	Segment	Road No.	Segment
21-4-11.00	B	22-4-33.02	C	22-7-12.01	D
21-5-27.01	B	22-5-13.00	H	23-4-10.01	D
*2 l-6-26.00	A	*21-6-26.01	A	*21-6-26.02	A
22-5-23.01	B	23-4-19.00	A		
21-6-35.00	A	22-5-23.01	A	23-4-19.01	A
*21-6-36.01	B	22-5-23.02	A	23-4-19.02	A
22-4-06.00	B	*22-6-04.00	D	23-4-28.00	C
22-4-06.00	C	22-7-i 1.00	C	234-28.00	E
22-4-06.00	E	22-7-12.00	B	23-5-17.00	A
22-4-08.01	B	22-7-12.01	B	23-5-17.00	C
24-4-05.00	B	24-4-05.02	A	23-4-09.02	B

2. Natural surfaced roads needing to be rocked where BLM use warrants. This treatment would also include designing additional drain dips 01 culverts.

Road No.	Segment	Road No.	Segment	Road No.	Segment
*2 l-4-05.00	A	'21-4-05.01	A	21-I-28.00	D
21-5-27.00	B	21-5-27.01	B	*21-6-33.03	A
22-4-03.00	B	22-4-35.00	A	22-5-25.02	A
*22-6-04.01	C	22-6-08.02	A	22-6-14.00	A2
22-7-02.05	B	23-4-27.02	A	234-07.00	C
23-4-07.00	D	23-4-l 1.00	A	23-4-l I .07	A
23-4-12.00	A	234-13.00	A	23-4-17.01	A
23-4-23.01	A	234-24.00	A	23-4-24.01	A
23-4-27.04	A	23-4-27.06	A		

3. A very small portion of short spurs or roads could be decommissioned if not needed for fire access or other future needs.

Road No.	Segment	Road No.	Segment	Road No.	Segment
21-4-05.02	A	--*21-6-27.00	A	21-6-33.01	A
22-4-09.01	B	' 226-21.00	B	22-7-01.00	A
23-4-07.01	A	23-4-09.02	A	23-4-17.02	A
*23-4-06.00	H	23-4-27.01	A	23-4-35.00	A
23-4-35.01	A	- '. *23-5-13.00	A	24-4-03.02	A
24-4-04.0 I	A	24-4-09.00	A		

4. Midslope roads built with sidecast material and having visual evidence of sliding. The sidecast material needs to be excavated and placed on stable areas.

-There was not enough time to more fully develop this category. It is recommended that it be developed in the next iteration of watershed analysis.

* Roads denoted with an asterix are considered highest priority either because of major erosion problems or because of high potential of sliding into a higher value fish use area.

PUBLIC PARTICIPATION

a hrmg the watershed analysis process for East Elk WAU, key agencies and landowners were contacted. **Preliminary** findings were presented during a July 25th meeting. A letter from Robin Biesecker, forester for Rocking C Ranch, owned by Carol A. Whipple, expressed ccwem about decommissioning of roads as well as how current environmental laws are effectively increasing the cost of management on private lands. These concerns as well as the need to maintain tire access to private and public lands influenced the road related recommendations in this WAU. As was stated earlier, any road work will be evaluated on a case by case basis with input from the affected landowners.

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